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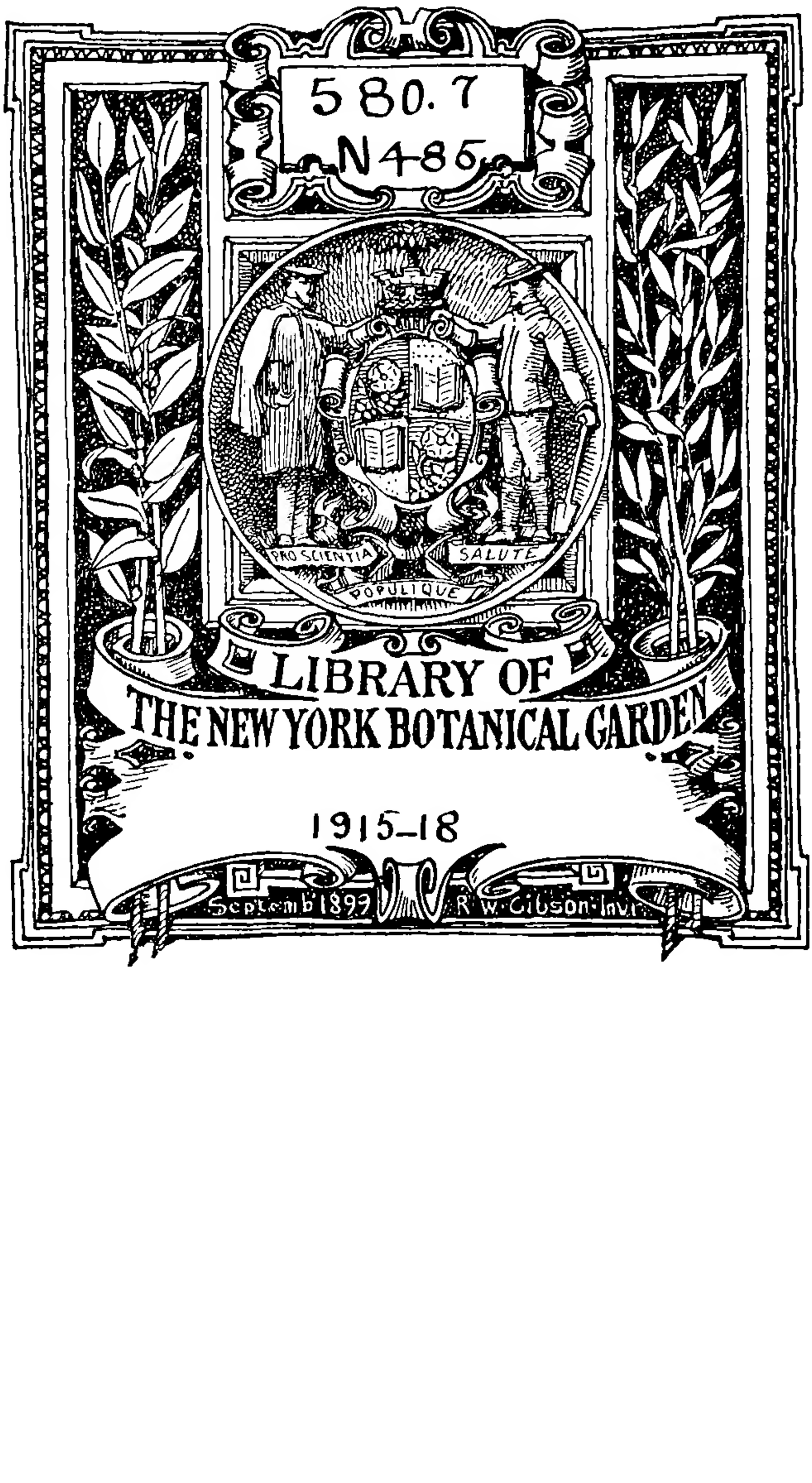
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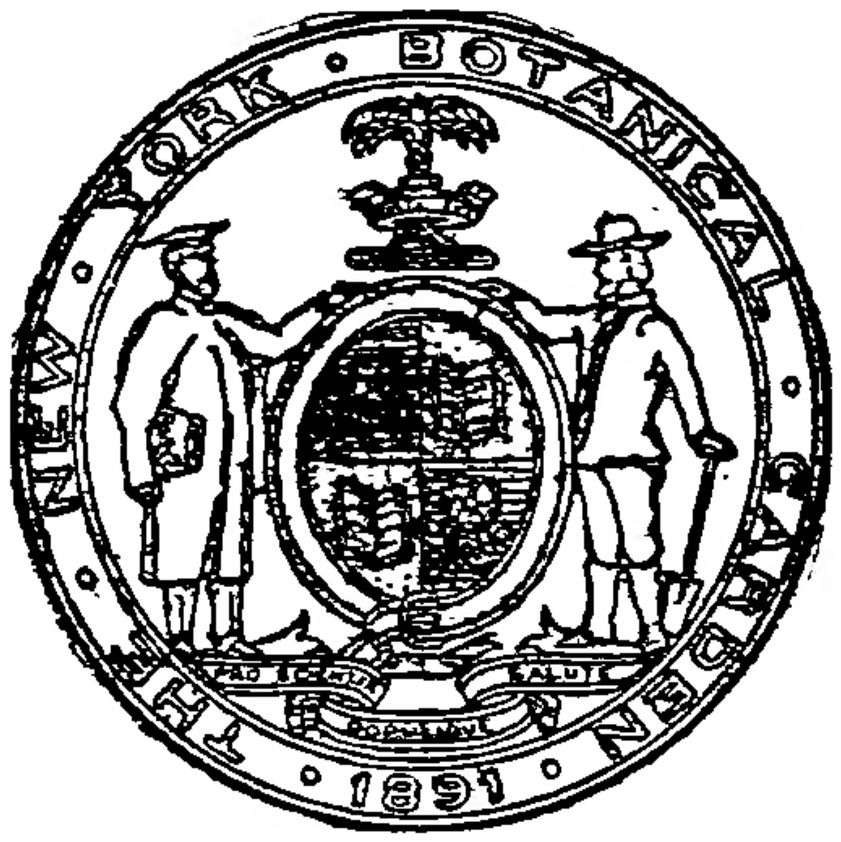
The New York Botanical Garden

Volume IX, 1915–1918

BULLETIN

OF

The New York Botanical Garden



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1915–1918

PUBLISHED FOR THE GARDEN

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HENRY G. PARSONS, *Supervisor of Gardening Instruction*

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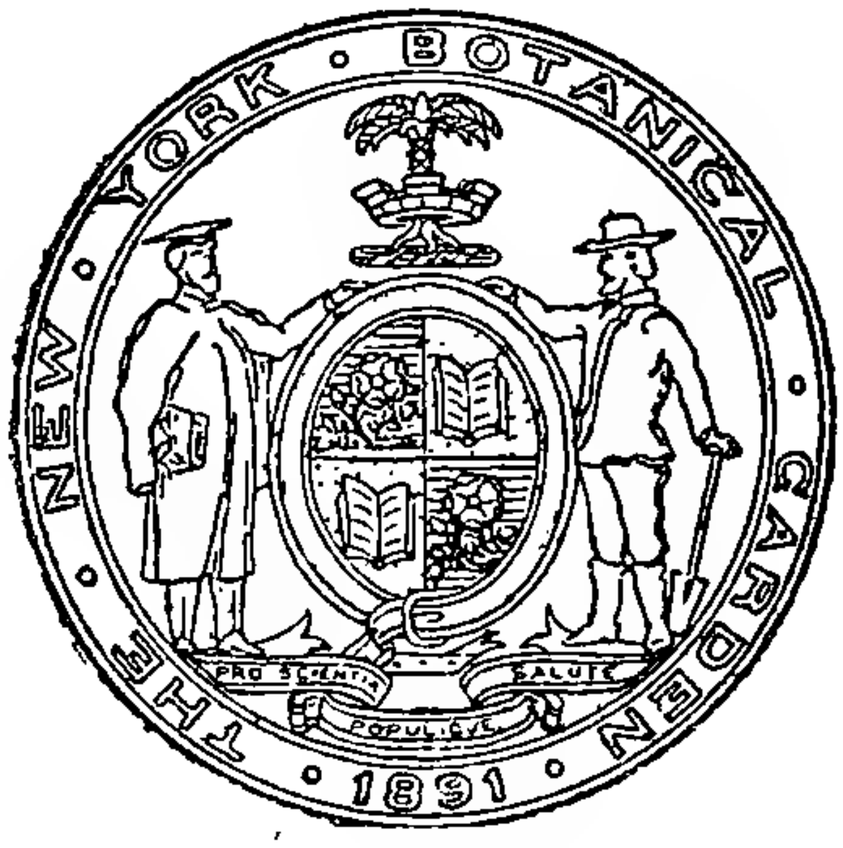
OF

THE NEW YORK BOTANICAL GARDEN



[ISSUED MARCH 31, 1915]

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REPORT OF THE SECRETARY AND DIRECTOR-IN-CHIEF FOR THE YEAR 1914

(*Accepted and ordered printed, January 11, 1915.*)

To the Board of Managers of the New York Botanical Garden.

Gentlemen: I have the honor to submit herewith my report as Secretary and Director-in-Chief for the year ending January 11, 1915.

The work of the institution has been satisfactorily continued during the year, together with considerable development. New construction has included the completion of additional paths in the pinetum and in the north meadows and the partial construction of other paths in the north meadows and near conservatory range 2 on the eastern side of the grounds; areas of wet lands along The Bronx River and elsewhere have been reclaimed by filling, and considerable grading and drainage have been accomplished. Additional plantations have been established and some of the older plantations variously rearranged and modified. The number of kinds of plants under cultivation has been increased, these now aggregating 13,444; the labeling of this great plant collection has been continued, over 4,700 display labels having been prepared for plants in the grounds and in the public conservatories.

The museum and herbarium collections have been materially increased by over 44,000 specimens, most of which have been incorporated, but some remain in storage.

Over 900 bound volumes were added to the library, this collection now aggregating 26,299 volumes. Additional cases are now much needed for the preservation and display of museum and herbarium specimens and for books, and it is hoped that these may be obtained during the coming year. Laboratory work with advanced students and investigators from other educational institutions has been continued over a wide range of subjects, including further development of work in plant genetics. A new departure in investigational work was made by cooperating with the agricultural department of Columbia University. Some investigational work was done in plant pathology, and it is desirable that this increasingly important topic should be further developed. A commencement has been made along lines of experimental horticulture, looking forward to increased attention to this important subject.

Direct public educational work has been continued, by 33 public lectures delivered on Saturday afternoons from April 4 to November 14, by lectures and demonstrations to schools, and by the system of guidance of parties to various portions of the grounds, buildings, and collections; a great deal of information has been given out in this way. An increasing amount of information has been supplied by correspondence.

Exploration work has been continued in regions botanically little known and material additions to scientific knowledge have resulted. Exhibitions of plants and flowers, given in cooperation with the Horticultural Society of New York in May, June, and August, were highly successful.

Publications of the year include Volume 15 of the *Journal*, Volume 6 of *Mycologia*, 3 parts of *North American Flora*, *Bulletin* No. 30, together with a portion of *Bulletin* No. 31, issued in advance, and 12 numbers of *Contributions;* Volume 5 of *Memoirs*, containing Mr. Norman Taylor's work on the local flora of the vicinity of New York, has been completed for publication in January.

The hemlock forest and other natural features of the grounds have been continually guarded. The increasing number of visitors makes the care of areas maintained in the wild condition more difficult, but up to the present time no appreciable damage has been done to them; it is desirable, however, that the patrolling of these areas should be somewhat increased and that a large amount of additional guard-rail along paths and trails should be supplied; nearly 4,000 running feet of guard-rail were set during the year to protect natural features and plantations. As the number of visitors on Sundays and holidays during the summer averaged about 30,000, these precautions were necessary, and as a result the damage suffered was negligible; it appears, indeed, there is now little desire or intention on the part of the public to damage either natural or artificial features, which is a very great improvement over the condition in previous years.

The permanent funds of the corporation have not been materially increased during the year, but a bequest of $25,000 is included in the will of the late Mrs. Maria DeWitt Jesup, and another of $1,000 in the will of the late Jacob Langeloth, which, when paid, will bring the permanent endowment to about $545,000; it is desired that this endowment should be increased to at least $1,000,000, in order to further expand the botanical and horticultural work of the institution and to amplify the planting of its grounds.

Grading and Drainage

In the northern part of the grounds, near the Woodlawn Avenue entrance, where space has been provided for several years for surplus material excavated by contractors in the vicinity, over 2,000 yards of filling were deposited by contractors, as directed, without expense to the Garden; this area of about 2 acres has now been nearly sufficiently filled to permit its final shaping and planting, after sufficient top-soil has been obtained. In the north meadows east of the Bronx River, marshy and wet grounds were further

reclaimed; there still remain a few areas in these meadows where additional filling can be used. South of the boulder bridge, a back-set of the river was filled, eliminating an unsightly feature. At conservatory range 2, along the Bronx Boulevard, a considerable area was regulated and graded, and work on rock excavation is going forward there during the winter. Some rock excavation was accomplished in the rear of the museum building. All the rock excavated is being used in the building of paths and all the earth excavation was used in filling.

To obtain more satisfactory road drainage, the grass gutters were lowered along several hundred feet of road edge. The gradual wearing down of roads and the wash of road detritus into the gutters makes the lowering of sod borders necessary from time to time, but they are far more attractive than stone or concrete gutters and thus worth the trouble of caring for them. About 250 feet of drain-pipe connecting with drains previously built were laid during grading operations.

Roads and Paths

No new road construction was done during the year. It has not been practicable to surface the unfinished road in the arboretum, because the new Bronx Boulevard, into which it opens, is not yet paved.

Considerable progress was made in the extension of the path system, including the opening of a path through the pinetum from the eastern end of the flower gardens at conservatory range 1 leading toward the museum building, and a loop of path at the south end of the north meadows, east of the Bronx River and paralleling the river for over 600 feet; preliminary work on paths about 430 feet long in the north meadows and on paths aggregating about 1,100 feet in length near conservatory range 2 has been accomplished by grading, and the Telford rock foundation for this is now being excavated.

The maintenance of roads has been accomplished by

the Park Department, as contemplated by the Garden Charter, but the maintenance of paths has been effected by Garden labor.

All bridges carrying roads and paths are in good order and have required no special attention during the year.

Guard-rails were set along paths in various parts of the grounds, as already mentioned, and guard-rails previously set have been painted.

Water Supply

Water pipes, wherever laid throughout the reservation, have required little attention, no leaks having become apparent. Evidence of rusting and clogging in one of the small pipes running south from the economic garden will require its renewal for a length of three or four hundred feet. There is still need for an additional water supply system through parts of the flower gardens and on the terrace at conservatory range 1.

Buildings

With the exception of a hay barrack, located at the nurseries, no new buildings have been constructed. Work on the older buildings has been essentially in the nature of ordinary repairs, but, as the structures become older, an increasing expenditure for repairs is evidently necessary in order to ensure satisfactory maintenance. At the museum building, the balustrade on the west side of the approach was torn down and rebuilt, its foundation having been weakened by settlement; a great deal of repair work was necessary on the roof of this edifice, where a number of leaks developed and some of the ceilings in rooms on the upper floor were consequently damaged; this work was in continuation of the repair of defects in the roof which have given trouble for several years. At power house 2, the brickwork of a boiler was taken down and rebuilt and the boiler reset. Replacement of steam pipes in the greenhouses and in the trench from power house 1 to

the museum building has been necessary from time to time. The walls of both public conservatory ranges have been repointed, and all broken glass replaced, but, considering the great area of glass to be maintained, the expense for new glass has been trivial. All necessary painting of buildings has been accomplished; it is desirable that some additional interior painting in the museum building be done this year.

The report of the Superintendent of Buildings and Grounds hereto appended gives details of maintenance and construction.

Need of an Additional Wing to the Museum Building

The rapid and continuous increase of collections in the museum building makes additional space for display and storage of specimens and books very desirable, and more library room is needed for the accommodation of students. The Scientific Directors have considered this topic and on October 10, 1914, adopted the following report of a committee, which was duly transmitted to the Board of Managers:

The original plan of Mr. R. W. Gibson, Architect, for the completed museum building contemplated the construction on its north side of two wings, each about 100 feet long and four stories in height, in the rear of the present structure, these to be ultimately connected by a two-story pavilion, leaving an interior court. Considerable grading has been accomplished from time to time, looking forward to the construction of these wings, and some still remains to be done near the northern corner of the present edifice.

The collections forming the public museum, the herbarium and the library have now reached such development as to make one of these wings absolutely essential for their proper installation and preservation, and the constantly increasing number of students and investigators using the laboratory equipment makes additional laboratory space necessary. While either of the two proposed wings would provide the additional space desired, the western wing should be the first constructed, because that would

complete the side of the building facing the Mosholu Parkway entrance and would be the more desirable of the two for laboratory development.

In a preliminary way, the uses of this wing may be outlined as follows:

1. *Basement Floor.* Additional storage space and workrooms; a lecture room to seat about 150 auditors, to be used for such lectures, meetings, special plant and flower exhibitions, and other functions which are not adaptable to the great size of the present lecture hall.

2. *First Floor.* Extension of the economic museum; a room for the Board of Managers and for members of the Garden.

3. *Second Floor.* Extension of the systematic museum; laboratory rooms for plant pathology and physiology.

4. *Third Floor.* Library, reading and stack rooms, herbarium, laboratory and study rooms. It would be desirable to expand the library into the laboratory room just east of it and transfer the work accomplished in that room to the additional wing. The library and herbarium have reached such proportions that space in the laboratories has had to be given over to them.

The cost of this wing and its equipment with necessary cases and furniture would be from $80,000 to $100,000.

Boundary Walls and Fences

No extension of boundary fences has been possible during the year. The fence on the boundary line of Fordham University, about 2,000 feet long, was completely painted in the early part of the year, and the Bronx Boulevard boundary fence on the eastern side of the grounds, also about 2,000 feet long, has been painted this winter. The boundary fence along the right of way of the New York Central & Hudson River Railroad Company, about 3,600 feet long, built some years ago by the Railroad Company and to be maintained by them, is in good condition. The northern boundary of the reservation, about 1,200 feet long, remains unfenced; the proposal of the City to construct a high level viaduct to carry a boundary street along this line has not yet been carried out.

Natural Features

Continuous attention has been given to the protection of the natural woodlands against fire and vandalism by our patrols, and this precaution, together with the guard-rails along paths and trails, have prevented any appreciable damage to natural features. The night patrol of the grounds established last year has proved a valuable precaution, a number of fires having been extinguished by the night watchman before spreading, and disorder after dark has been very much reduced. A considerable number of dead trees have been cut down and this work is being continued during the winter, but the tree mortality of the woodlands is not greater than in forests generally; the damage effected by the hickory bark beetle and the hemlock borer during the two previous years has been very much reduced, although both insects are still in evidence. Up to the present time there has been no appreciable diminution of beauty of the hemlock forest or of the valley of the Bronx River.

Plants and Planting

Additions have been made to all the collections of plants, much out-of-door planting having been accomplished both in the spring and in the autumn, largely by material from the nurseries, which have thus been appreciably reduced. In the spring, the flower gardens at conservatory range 1 were increased by about 500 running feet of herbaceous plants, backed by an equal length of low evergreens. The total length of herbaceous plantations now under cultivation, including those about conservatory range 1 and its path approaches and those along the west border and in the valley of the herbaceous garden, aggregates considerably over one mile. A noteworthy decorative feature was added by the planting of low rhododendrons and other plants of the heath family around the lower basin of the fountain at the museum building, made possible by an appropriation from the income of the John Innes Kane

Fund. The collections of spruces and firs north and west of conservatory range 1 were considerably modified by moving specimens of a number of species from exposed situations in which they were not making satisfactory growth, to protected spots near the west border screen of trees, and these plants are doing better in their new locations. The purchase of specimens for the new collections was made possible by the following contributions to the Plant Fund:

Daniel Guggenheim	$500
James A. Scrymser	300
Edward S. Harkness	250
Felix M. Warburg	100
Mrs. E. H. Harriman	100

The collections under glass have not been materially modified, though many additions have been made to the collections in both public conservatory ranges, the collection of cacti brought together in cooperation with the Carnegie Institution of Washington having been materially augmented; a large number of kinds of plants in the propagating houses has not yet been put on public display. For details of the composition of the collections, reference is made to the report of the Head Gardener herewith submitted.

Museums and Herbarium

The general arrangement of the museum and herbarium collections remains as in previous years, but important additions have been made to them in many groups. The need for additional museum cases mentioned in my last annual report still exists; funds for the construction of only two additional cases were available during the year. The specimens received during the year were mostly distributed into existing cases, but many thousand specimens received in previous years remain in storage.

Details of the museum and herbarium work will be found in the report of the Head Curator of the Museums and Herbarium and in that of the Honorary Curator of the Economic Collections hereto appended.

Library

The satisfactory increase of the library during the year was made possible by the following contributions to the Special Book Fund:

James B. Ford	$1,000
N. L. Britton	300
John D. Archbold	250
J. Pierpont Morgan	250
H. C. Frick	250
Mortimer L. Schiff	200
George W. Perkins	200
Cleveland H. Dodge	100
Lewis R. Morris	100
Francis Lynde Stetson	100
Samuel P. Colt	100
Samuel Thorne	100
Myles Tierney	100
George F. Baker	100
M. F. Plant	100
Arthur F. Estabrook	100
Thomas H. Hubbard	100
Edgar L. Marston	100
Henry W. de Forest	50
Frederick Strauss	50
Paul M. Warburg	50
Charles P. Rand	50
J. Montgomery Hare	50
James Douglas	25

The most noteworthy accession was the botanical library of the late Professor Lucien M. Underwood, who was for many years Chairman of the Scientific Directors, which was bought from his estate. The report of the Bibliographer and that of the Librarian hereto appended contain details of the accession of books and the use of this collection.

Laboratories and Experimental Gardens

Facilities for research in the laboratories and in plant genetics were supplied during the year to 20 students, most of them from other institutions, and the subjects of their investigations are indicated in the report of the Director of the Laboratories herewith submitted. Five of

these students were aided by grants from the income of the Henry Iden Fund for resident research scholarships. The fields of plant breeding and plant pathology offer such attractive possibilities for important discoveries and generalizations that effort should be made to provide all necessary facility for the advancement of such investigations. Noteworthy study in the breeding of Indian corn was carried on by Professor Harper, and in the breeding of chicory, rose mallows, and *Coleus* by Dr. Stout.

For the purpose of obtaining additional knowledge relative to plant breeding work in Europe, Dr. Stout visited portions of Germany, Holland, and England during the summer, and obtained most of the information desired, although his trip was cut short by the outbreak of the European war.

It is interesting to record that the Tropical Laboratory at Cinchona, Jamaica, which was leased by the Garden from the Jamaican Government for ten years, but taken back by the Jamaica authorities at the termination of the lease last year, is now to be maintained by the British Association for the Advancement of Science.

Public Instruction

The public lectures delivered on Saturday afternoons from early spring until winter had an average attendance of 99 auditors. The titles of these lectures are recorded in the report of the Assistant Director, to which reference is also made for a record of publications issued and of scientific meetings held. The Garden publications, as in previous years, were aided by the income of the David Lydig Fund, bequeathed by Charles P. Daly. At the flower exhibitions given in cooperation with the Horticultural Society of New York, prizes were awarded and paid to competitors from the income of the William R. Sands Fund. The system of guidance of visitors and of parties from schools has been continued with satisfactory results.

Exploration

The most important exploration trip accomplished was that of Dr. and Mrs. J. N. Rose to Peru, Bolivia, and Chile for the collection of cacti, in continuation of cooperation with the Carnegie Institution of Washington in the study of these plants. They visited the desert regions of these countries and obtained living plants and museum and herbarium specimens of most of the many kinds of cacti which grow there, and these collections have all been received at the Garden, for the most part in capital condition, forming the most important addition to our cactus collections ever made on a single expedition. The Garden's cooperation in this work was effected through an appropriation from the income of the Darius Ogden Mills Fund. By the use of the income of the same fund, Dr. J. A. Shafer explored the Porto Rico island Vieques in the spring and the Naguabo mountain range of Porto Rico in the summer, bringing back important collections; this work was in cooperation with the New York Academy of Sciences, the American Museum of Natural History, and the Insular Government of Porto Rico; further cooperation in this work was effected by Dr. and Mrs. Britton, accompanied by Mr. John F. Cowell and Dr. Frank E. Lutz, who visited Porto Rico and the islands of the Mona Passage in February and March. Dr. Marshall A. Howe visited parts of Georgia and northern Florida in January for the collection of cryptogams. In late May and early June, Dr. Britton continued botanical studies in Bermuda, accompanied by Mr. Stewardson Brown and Mr. Peter Bisset. In connection with the investigation of the flora of the region within 100 miles of New York City, prosecuted for several years by Mr. Norman Taylor, considerable collecting was done at various points by several members of the staff.

Preservation of Native Plants

By the aid of the Caroline and Olivia E. Phelps Stokes Fund for the preservation of native plants, copies of the

colored illustrations of wild flowers needing protection were framed and have been distributed to schools, colleges, and museums, as suggested in my last annual report. These attractive frames of reproduced paintings by Miss Mary E. Eaton have been much admired and will doubtless be an influence in the preservation of wild plants. In February, all public schools and high schools in The Bronx were invited to submit pupil compositions on the preservation of our native plants, and this brought out a considerable number of such compositions, which were denominated "Stokes Prize Essays." The best of them have been published in the Garden *Journal*.

Investigations

Records of special studies by members of the staff and of students working under their direction are mentioned in the several reports hereto appended. Administrative and curatorial work required most of the time of the staff, but, collectively, considerable investigation has been accomplished.

The Charles Budd Robinson Memorial Fund

Dr. Charles Budd Robinson, formerly an assistant curator of the Garden, and subsequently an employee of the Bureau of Science of the Government of the Philippine Islands, was murdered by fanatics on the Dutch Island of Amboina in December, 1913, while pursuing botanical investigations looking toward a comparison of the floras of the Dutch East Indies with those of the Philippine Archipelago, this being the first case of a student trained at the Garden losing his life while in the performance of his duty. Pursuant to resolutions adopted by the Scientific Directors, the Board of Managers at the meeting of April 16, 1914, voted to accept a fund to be contributed by friends and associates of Dr. Robinson, its income to be available, at intervals, for aiding botanical exploration. Subscriptions and contributions to this fund have now been received as follows:

Officers and employees, Bureau of Science, Philippine Islands...	$174.30
Staff of the New York Botanical Garden and other American botanists	315.00
Relatives and personal friends of Dr. Robinson	60.00
Residents of the Island of Amboina	95.24
Total	$644.54

It is planned to hold this fund open for further contributions.

The Addison Brown Fund

The will of Judge Addison Brown, who was for many years President of the Garden, contains the following provisions:

Out of the residue of my estate (excluding the property referred to in the Eleventh Article), after satisfying the foregoing bequests and charges, I give and bequeath as follows:

(3) To the New York Botanical Garden, I give two hundred shares of the preferred stock of the United States Steel Corporation, to be known as the Addison Brown Fund, the income and accumulations from which shall be applied to the founding and publication, as soon as practicable, and to the maintenance (aided by subscriptions therefor), of a high-class magazine bearing my name, devoted exclusively to the illustration by colored plates of the plants of the United States and its territorial possessions, and of other plants flowering in said Garden or its conservatories; with suitable descriptions in popular language, & any desirable notes & synonomy, and a brief statement of the known properties & uses of the plants illustrated. The Garden Managers may, from time to time, change the investment of said fund, as necessary, applying the income to said uses.

This bequest was duly received by the Garden and the stock subsequently sold, realizing $20,766.50. The Scientific Directors have been examining samples of reproductions of paintings of American plants, and the Board of Managers have authorized the publication of a sample number of the magazine.

Administration and Organization

At the annual meeting of the Corporation held January 12, 1914, amendments to the Constitution were adopted,

providing for the election of two vice-presidents instead of one and for an increase in the number of elective managers from five to six in each class.

At the meeting of the Board of Managers held June 17, 1914, a revision of the By-Laws was adopted.

In the Garden *Journal* for July, 1914, administrative documents were printed, including the Act of Incorporation as amended by the Laws of 1914, the Constitution, By-Laws, Regulations for the Office of Director-in-Chief, Provisions for Contributing Membership, and Provisions of the Charter of the City of New York for Maintenance of the Garden, and these were subsequently reprinted in pamphlet form.

The By-Laws include the following provisions for the Women's Auxiliary:

> The Women's Auxiliary shall consist of at least twelve members. Additional members may be elected at any meeting of the managers after nomination by the Auxiliary. This committee shall aid the managers in conducting receptions and other public functions, in obtaining contributing members, and in such other objects as may be referred to it by the Board of Managers. Honorary members of the Women's Auxiliary, chosen from women who have rendered noteworthy service to the Garden, may also be appointed by the managers after nomination by the Auxiliary.

Fifteen women have been elected as members of the Auxiliary, and have held several meetings; the Auxiliary took charge of the spring inspection of grounds, buildings, and collections on Thursday, May 7, 1914, at which time about 300 members of the Garden and their friends visited the grounds and buildings. Arrangements for a similar autumn inspection were made, but were canceled on account of the disturbed conditions caused by the European war.

The detailed administration of the Garden has largely been referred to Dr. W. A. Murrill, Assistant Director, and to Mr. R. S. Williams, Administrative Assistant, under my

immediate supervision. I have directly supervised all new construction and the installation and care of collections, with the assistance of Mr. Arthur J. Corbett, Superintendent of Buildings and Grounds, Mr. George V. Nash, Head Gardener, and Dr. John K. Small, Head Curator, and take occasion here to express my high appreciation of the efficiency of all these officers, as well as of all other employees. Such time as I have had for scientific investigation has been given to the continuation of the cactus investigation in cooperation with Drs. D. T. MacDougal and J. N. Rose, of the Carnegie Institution of Washington, to studies of the West Indian flora, and to assisting Mr. Norman Taylor in his production of the forthcoming flora of the vicinity of New York City.

Financial Considerations

As shown by the report of the Treasurer, permanent funds of the corporation now aggregate very nearly $523,000. Provisions of wills previously probated contain $25,000, subject to life interests. The will of Mrs. Maria DeWitt Jesup, admitted to probate June 24, 1914, contains a bequest of $25,000, and the will of Jacob Langeloth, filed for probate August 29, 1914, contains a bequest of $1,000. These sums total $570,000. A total endowment of not less than $1,000,000 is earnestly desired in order to enable the Board of Managers to expand the usefulness of the institution.

The city appropriation for maintenance for 1915 is $107,163, the same as for 1914. The total income from funds of the corporation, membership dues, and publications for 1915 is estimated at about $35,000, the total amount thus available for expenditures during 1915 being about $142,000. About $10,000 additional is greatly desired for expenditure during 1915, for the extension of horticultural experimentation and display and the purchase of plants and books.

Reports Appended

Reports are appended by the Assistant Director, the Head Gardener, the Head Curator of the Museums and Herbarium, the Honorary Curator of the Economic Collections, the Director of the Laboratories, the Librarian, the Bibliographer, and the Superintendent of Buildings and Grounds; and a schedule of expenditures by the Accountant.

Respectfully submitted,
N. L. Britton,
Director-in-Chief.

REPORT OF THE ASSISTANT DIRECTOR

Dr. N. L. Britton, Director-in-Chief.

Sir: I have the honor to submit the following report for the year 1914.

The details of maintenance are chiefly outlined in the various reports to follow. I submit herewith for your files the weekly reports of the Superintendent of Buildings and Grounds, which show an unusual amount of work accomplished during the year by our laborers.

The season has been remarkable in many ways. The spring was late and cool; the summer wet, but fortunately without floods or serious windstorms; the autumn very dry, ending with bountiful rains before freezing weather; and the closing days of the year the coldest on record.

Fewer mosquitoes and elm beetles appeared than ever before, probably owing to unusual weather conditions. The hickory bark beetle and the hemlock borer have apparently been kept in check by our destructive and preventive measures and by the work of woodpeckers and other natural enemies. The brood of white grubs which destroyed some of our lawns two years ago matured early in the season and escaped in the adult form. The army worm, new to the present generation in this vicinity, appeared on our borders but did no damage within our boundaries.

Publications

Journal

The *Journal* has been published for each month during the year, making a volume of 361 pages, with 14 plates.

Mycologia

This periodical has appeared on alternate months during the year, making a volume of 323 pages, with 35 plates and 1 figure.

North American Flora

Volume 10, part 1, containing descriptions of Agaricaceae (pars), by W. A. Murrill, appeared July 28, 1914.

Volume 29, part 1, containing descriptions of the families Clethraceae—Ericaceae, by J. K. Small, N. L. Britton, P. A. Rydberg, and LeRoy Abrams, appeared August 31, 1914.

Volume 34, part 1, containing descriptions of the family Carduaceae, by P. A. Rydberg and H. M. Hall, appeared December 31, 1914.

Bulletin

Bulletin No. 30, with 78 pages, was issued April 4, 1914. It contains the annual reports of the Director-in-Chief and other officers for the year 1913.

A separate in advance from *Bulletin* No. 31, on Philippine Mosses by R. S. Williams, appeared July 23, 1914.

Contributions

Contributions by members of the staff or students of the Garden, reprinted during the year from other than Garden publications, are as follows:

No. 161. West Indian Mosses—I, by Elizabeth G. Britton.

No. 162. Phytogeographic Notes on the Rocky Mountain Region—I. Alpine Region, by P. A. Rydberg.

No. 163. New Ferns from Tropical America—III, by Margaret Slosson.

No. 164. Studies of West Indian Plants—V, by Nathaniel Lord Britton.

No. 165. Central American Mosses, by Elizabeth G. Britton and R. S. Williams.

No. 166. Studies of Plant Growth in Heated Soil, by Guy West Wilson.

No. 167. The Identity of the Anthracnose of Grasses in the United States, by Guy West Wilson.

No. 168. Phytogeographical Notes on the Rocky Mountain Region—II. Origin of the Alpine Flora, by P. A. Rydberg.

No. 169. Some Midwinter Algae of Long Island Sound, by Marshall A. Howe.

No. 170. Notes on Rosaceae—VII, by P. A. Rydberg.

No. 171. A Revision of the Genus Vittaria J. E. Smith, by Ralph C. Benedict.

No. 172. Phytogeographical Notes on the Rocky Mountain Region—III. Formations in the Alpine Zone, by P. A. Rydberg.

No. 173. Notes on Rosaceae—VIII, by P. A. Rydberg.

Lectures

Public Lectures

Illustrated public lectures on botanical subjects have been given in the museum building on Saturday afternoons from April to the middle of November, as outlined below. The total attendance for the year has been 3,264, averaging 99 for each of the 33 lectures; the maximum attendance being 215 on September 26.

April 4. "An Excursion through the United States with Distinguished Foreign Botanists," by Dr. G. E. Nichols.

April 11. "The Occurrence and Significance of Variation in Plants," by Dr. A. B. Stout.

April 18. "The Seaweeds of New York City and Vicinity," by Dr. M. A. Howe.

April 25. "The Petrified Forest of Arizona," by Dr. Arthur Hollick.

May 2. "Some Interesting Trees Seen on My Travels," by Dr. W. A. Murrill.

May 9. "Wild Flowers of Spring," by Dr. N. L. Britton.

May 16. "American Orchids," by Mr. G. V. Nash.

May 23. "The Protection of Shade Trees against Insect and Fungous Enemies," by Dr. F. J. Seaver.

May 30. "Some Plants of Our Swamps," by Dr. J. H. Barnhart.

June 6. "The Soil, the Basis of Success in Gardening and in Other Lines of Productive Work," by Mr. George T. Powell.

June 13. "Diseases of Potatoes," by Dr. Mel. T. Cook.

June 20. "Floral and Scenic Features of Porto Rico," by Dr. M. A. Howe.

June 27. "Haïti, the Negro Republic," by Mr. G. V. Nash.

July 4. "The Secret of the Heather," by Mr. F. V. Coville.

July 11. "Explorations in Mexico," by Dr. W. A. Murrill.

July 18. "Arctic and Alpine Plants," by Dr. P. A. Rydberg.

July 25. "Wild and Cultivated Plants of Bermuda," by Dr. N. L. Britton.

August 1. "Reef-building and Land-forming Seaweeds," by Dr. M. A. Howe.

August 8. "Medicinal Plants Found in the Vicinity of New York City," by Dr. Wm. Mansfield.

August 15. "Evergreen Trees and Shrubs," by Mr. G. V. Nash.

August 22. "Woody Fungi and Their Injurious Effects on Trees," by Dr. W. A. Murrill.

August 29. "The Trees of the Rocky Mountains," by Dr. P. A. Rydberg.

September 5. "The Life History of a Tree," by Dr. C. S. Gager.

September 12. "Diseases of Cultivated Plants," by Dr. G. P. Clinton.

September 19. "Interrelations between Botany and Geology," by Dr. Arthur Hollick.

September 26. "Wild Flowers of Autumn," by Dr. N. L. Britton.

October 3. "The Economic Importance of Fungi," by Dr. F. J. Seaver.

October 10. "Carnivorous Plants," by Dr. J. H. Barnhart.

October 17. "The Flora of New York and Vicinity," by Mr. Norman Taylor.

October 24. "The Production and Utilization of Plant Hybrids," by Dr. A. B. Stout.

October 31. "Botanical Travels in Europe," by Dr. W. A. Murrill.

November 7. "A Botanist in India and Java," by Dr. C. F. Millspaugh.

November 14. "The Influence of Radium on the Production of Field Crops," by Dr. H. H. Rusby.

School Lectures

A special lecture on "The Cultivation of Plants" was given by Mr. Nash on April 22 and 27 to children of several of the public schools of The Bronx who were going into the school gardens on Arbor Day. This lecture was attended by 1,400 children, accompanied by their teachers.

Docentry

About 1,000 visitors availed themselves during the year of the privilege of viewing the grounds and collections under guidance. Mr. Percy Wilson, Associate Curator, was specially detailed for docentry work, and he has been assisted by Mr. R. S. Williams and Mr. H. W. Becker.

Scientific Meetings

The monthly conferences of members of the staff and students have been continued, and a report of each meeting has been published in the current numbers of the *Journal*.

The Torrey Botanical Club has met each month as usual in the morphological laboratory in the museum building. On December 21, a special lecture on lichens was delivered

before the club in the lecture hall of the museum building by Professor Bruce Fink, of Miami University, Oxford, Ohio.

The Horticultural Society of New York, in cooperation with the New York Botanical Garden, held exhibitions of plants and flowers in the museum building on May 9 and 10, June 6 and 7, and August 15 and 16. Accounts of these exhibitions were published in the *Journal* for May, June and September.

A field meeting of the department of botany of the Brooklyn Institute of Arts and Sciences was held at the Garden on the afternoon of May 16, when a tour of inspection was made of the conservatories, plantations, and hemlock forest.

The convention of the American Association of Park Superintendents, in session at Newburgh and New York City August 24–27, visited the Garden in motor-cars on August 26, giving special attention to the hemlock forest and other park features.

Personal Investigations

A part of *North American Flora* containing descriptions of 281 species of the higher fleshy fungi, 39 of which were new, was completed and published early in the year; and another part, containing over 60 new species mostly obtained through explorations in tropical America, was completed with the help of Dr. Burlingham and Professor Pennington by the end of the year and sent to the printer in January.

The Underwood collection of fungi, consisting of 17,000 specimens, was incorporated in the mycological herbarium with the aid of Dr. Seaver. A great many other specimens sent in for determination from various parts of the country were also incorporated, and the herbarium is rapidly outgrowing the space allotted to it.

The popular illustrated articles on fungi in *Mycologia* have been continued, with the aid of colored plates and

halftones. Twenty-five species have been treated in this series during the year.

Respectfully submitted,

W. A. MURRILL,
Assistant Director.

REPORT OF THE HEAD GARDENER

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to submit herewith my report as Head Gardener for the year 1914.

Systematic Plantations

HERBACEOUS GROUNDS. There are 130 beds in this plantation; two new beds having been added, one each for the gourd and buttercup families. The beds devoted to the water-leaf, nasturtium, stonecrop, and morning-glory families have been enlarged. There are in the herbaceous collections about 2,860 species and varieties, and 612 individual display labels have been added. The details of the curatorial work here and in the other herbaceous collections have been under the direction of Mr. K. R. Boynton, Head Gardener's Assistant.

FRUTICETUM. This collection now contains 2,622 specimens. Including those still at the nurseries, there are represented 883 species and varieties. Representatives are included of 52 families and 135 genera. About 710 display labels have been added. The plants of the strawberry-shrub family were removed to the triangle across the path, and the rose group south of the tranverse path was incorporated with the rose group north of the same path, the vacated areas being planted with thorns.

SALICETUM. In the willow collection, 125 specimens represent 45 species and varieties.

DECIDUOUS ARBORETUM. This collection, including those native to the tract and still in the nurseries, contains 310 species and varieties. There are 946 individual trees, representing 31 families and 57 genera, and 472 display

labels have been made for this tract. The group of young Japanese cherry trees planted in the spring of 1913, the gift of Mrs. Florence Lydig Sturgis, is doing remarkably well.

PINETUM. The conifer collections contain about 1,500 specimens. There are 296 species and varieties, representing 3 families and 20 genera, and 747 display labels have been made for this tract. The collections of spruces and firs have been rearranged, the less hardy kinds having been removed to more sheltered situations: the firs to the vicinity of the border at the elevated railway approach and to the depression near power house 1, and the spruces for the most part to the vicinity of the west border and the shrubbery groups in that neighborhood, and a few to the vicinity of the long bridge. The planting of *Chamaecyparis* in the triangle at the west end of conservatory range 1 has been enlarged, extending as a background to the herbaceous bed along the path. The herbaceous bed opposite has been provided with a background of a double row of *Abies Veitchii.*

VITICETUM. About 50 species and varieties of climbers are represented here.

CONSERVATORIES. Including those at the propagating houses, the collections of tender plants represent about 9,000 species and varieties, embracing 207 families and 1,520 genera. The total number of plants in the public conservatories is 17,327.

Range 1. There are 10,712 plants in this range, distributed as follows: house 1, 263; house 2, 394; house 3, 465; house 4, 543; house 5, 1,318; house 6, 532; house 7, 980; house 8, 644; house 9, 143; house 10, 869; house 11, 448; house 12, 1,188; house 13, 532; house 14, 686; house 15, 1,575; cellar, 132. Some 2,045 display labels have been made for these collections.

Range 2. This range contains 6,525 plants, distributed as follows: house 1, 80; house 2, 140; house 3, 57; house 4, 1,233; house 5, 2,056; house 6, 1,611; house 7, 1,230; runway, 118. There have been 137 display labels added.

PROPAGATING HOUSES AND NURSERIES. There are here, excluding those used for special studies by the Director of the Laboratories, 9,069 plants. There have been 1,719 packets of seeds received, as follows: by gift, 26; by exchange, 1,039; by collection on expeditions, 14; by purchase, 640. In addition, 509 packets have been derived from collections on the grounds. The Director of the Laboratories has used house 2 and parts of other houses for his experiments and those of students. Houses 5 and 6 and a part of house 1 contain the cactus and other succulent collections under immediate study. The enclosure in the nursery, together with other areas outside, have been used by the Director of the Laboratories and students.

LABELING, RECORDING, AND HERBARIUM. Accession numbers 39,308 to 41,481 have been recorded, making a total of 2,174 accessions. A total of about 6,000 display labels have been made, as follows: deciduous arboretum, 472; fruticetum, 701; herbaceous grounds, 612; economic garden, 13; morphologic garden, 3; west border, 78; pinetum, 747; trees along roads and paths, 261; conservatory flower beds, 622; flower beds, elevated railway approach to conservatories, 1; elevated railway approach border, 5; conservatory range 1, 2,045; conservatory range 2, 137; rose bed, 283; conservatory court, 20. In addition to the above, 54 information signs were painted for range 1, and 4 for range 2.

The following plants have been acquired: by gift, 388, valued at about $285; by exchange, 600; by purchase, including 13,784 bulbs, 15,249; by collections made by members of the staff and others, 1,439; derived from seeds from various sources, 2,621; total, 20,569.

The herbarium of cultivated plants has been increased by 945 specimens. The collections contain approximately the following number of species and varieties: conservatories, 9,000; herbaceous, 2,860; fruticetum, 883; salicetum, 45; deciduous arboretum, 310; pinetum, 296; viticetum, 50; total, 13,444.

Miscellaneous Collections

MORPHOLOGIC GARDEN. No extended additions have been made here.

ECONOMIC GARDEN. This remains one of the most attractive exhibits on the grounds.

DESERT PLANTS. The collections of these plants are now becoming so extensive that it is possible to place only a part of them during the summer in the court of conservatory range I, where they form one of the prominent features of the open season.

CONSERVATORY LILY POOLS. These have been maintained, with the usual show of blossoms. The Paraguay royal water lily is grown here successfully, producing many flowers.

AQUATIC GARDEN. Additional planting has been done here, including bulbs of the Turk's-cap and meadow lilies.

RHODODENDRON BANKS. The plants here are doing very well, especially those on the bank at the south shore of the upper lake. *Rhododendron catawbiense* seems better suited for open situations with us that *R. maximum*.

ROSE BED. This continues to be one of the most attractive collections. It was necessary to replace only about 40 plants out of a total of over 400.

Other plantations maintained include the flower gardens in the immediate vicinity of conservatory range I; those at the elevated railway approach, the west border, along the path from the elevated railway to the conservatories; and groups of shrubbery in many parts of the reservation.

General Horticultural Operations

This work has been conducted with the following force: monthly, 2 foreman gardeners, 24 gardeners, 1 garden aid, 3 drivers during the open season; laborers, 20–24, the lesser number during the early and late part of the open season; parts of this force having been employed for a considerable part of the time on other than horticultural work.

H. W. Becker, foreman gardener, has had immediate charge of the work in the conservatories and propagating houses, with 15 gardeners, 1 garden aid, and 1 laborer.

John Finley, foreman gardener in charge of the outside work, has had the direction of 9 gardeners, 20 to 24 laborers, and 3 drivers.

The following new work has been accomplished, in addition to the regular routine gardening operations:

In the Spring

The woody plants of the plantations at conservatory range 1 were rearranged, many being removed and placed elsewhere on the grounds. The collections of firs and spruces in the pinetum were rearranged, as described in reporting upon that collection, and many new plants were purchased. At conservatory range 1, beds 9 and 10 were completed by the planting of the background, consisting mainly of evergreens, with some deciduous shrubs. The flower beds along the walk from the elevated railway to conservatory range 1 were backed with coniferous evergreens. A group of Austrian pines was established along the west border north of the woodlawn bridge approach. The group of conifers to the south of the same bridge was enlarged with material taken from the conservatory beds and from the nurseries; the group at the foot of the steps here was rearranged, many plants of evergreens, azaleas, and other members of the heath family being added. The area formerly in sod at the museum fountain was planted with rhododendrons, azaleas, *Pieris*, and *Leucothoe;* and these have done exceedingly well, with very few failures. Four swamp oaks were placed along the main drive in the north meadow. A group of weigelas was established at power house 1. A group of members of the rose family was placed between the road and path opposite the rose family in the fruticetum.

In the Fall

Work was concentrated on the nurseries, removing to other parts of the grounds all plants which could be safely transplanted at that time, and many plants were transferred to the herbaceous grounds and borders. Most of the work was done upon the woody plants, a large number of trees and shrubs having accumulated which were transferred to the fruticetum and arboretum, greatly enriching those collections. The triangle east of the boulder bridge was rearranged. The triangle between the lower and middle lakes was also rearranged and other shrubs added. The bed in the new path east of the Bronx River near the chestnut bridge was planted with elders and 9 swamp maples. The triangle near the sewer siphon in the same vicinity was planted with *Cornus*. The large plants of the Japanese barberry in the triangle east of the long bridge were transferred to the retaining wall near power house 2, other plants of the same species being substituted in this triangle. Four swamp oaks were placed along the path west of the Bronx River, north of the long bridge. At the east end of the upper bridge, on the north side, a planting was made of *Cornus*, matrimony vines, and thorns, closing the trail there made by the public. Just south of the upper bridge, along the path paralleling the river, 4 Lombardy poplars were planted, and also 1 at each corner of the bridge. Just north of the Mosholu Parkway approach, a group of shrubs was established, the gift of Mr. T. A. Havemeyer; these having been held in the nursery for two years until of sufficient size for permanent planting.

Investigations and Lectures

In addition to routine duties, I have continued my study upon the orchids for *North American Flora*, and have devoted much time to horticultural botany.

I have given three lectures in the regular courses of public lectures at the Garden, and two lectures to school children.

Respectfully submitted,

Geo. V. Nash, *Head Gardener.*

REPORT OF THE HEAD CURATOR OF THE MUSEUMS AND HERBARIUM

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I submit herewith the following report as Head Curator of the Museums and Herbarium for the year 1914.

The museum and herbarium collections were enlarged by specimens from many parts of the world. They were conserved by methods mentioned in previous annual reports.

ACCESSIONS. The specimens received for the public exhibits and for the study collections were accessioned from month to month in the Garden *Journal*. The most important additions, and those bearing more directly on the current work of the Garden, came from North America and South America. The manner of acquisition and the number of specimens received may be stated as follows:

By gift and purchase	27,807
By exchange	7,876
By exploration	8,492
	44,175

The value of the gifts is estimated at $1,212.60.

About 5,096 duplicate specimens were sent to other institutions and to individuals in exchange.

Museums

Neither exhibition cases nor mechanical devices were added to the museum equipment. The various exhibits were increased by some of the specimens received during the year and by others withdrawn from storage.

FOSSIL PLANT MUSEUM. The collections of this museum were improved throughout. Specimens were added from both the Old World and the New. The more important additions were several large specimens of silicified wood from Arizona and a collection of Pleistocene plants from Canada. The wall-cases, containing mainly plants of the carboniferous period, were supplied with type-printed labels to replace the former hand-printed ones.

Economic Museum. Several exceptionally valuable exhibits, in addition to miscellaneous specimens, were received for this museum: (1) A large collection of crude and refined rubber, together with implements and utensils used in the harvesting of the rubber-milk and its preparation for the market, presented by Dr. Carlos Manuel Asensi, through the American Museum of Natural History. (2) A complete representation of the fibers of the Philippine Islands, assembled and presented by Mr. Theodore Muller. (3) A collection of refined sugars and syrups, presented by by the American Sugar Refining Company. (4) A collection of rare crude and refined drugs, given by Dr. H. H. Rusby. The exhibits of foods and of fibers, as well as several smaller exhibits, were rearranged to better advantage. For other details concerning this museum, reference is made to the report of the Honorary Curator of the Economic Collections.

Systematic Museum. The exhibits of this museum remained as they were last year, except for the interpolation of new and additional specimens and the rearrangement of the contents of some of the cases.

The Synoptic Collection was enlarged by the interpolation of miscellaneous specimens and improved here and there by the rearrangement of exhibits.

The Local Flora was maintained in the same condition as it was last year, except for the addition of a few new specimens and the relabeling of some of those already installed.

The Microscope Exhibit was kept up as heretofore. Objects on view were renewed or replaced as occasion demanded.

The Plant Photograph Exhibit remained as it was last year. Many additional enlarged photographs are still held in storage, ready to be put on exhibition when proper frames for their display are constructed.

Herbaria

The equipment of the herbarium was increased by the addition of two herbarium cases. This addition, though

small, necessitated the rearrangement of the whole flowering-plant series.

Specimens from a wide geographic range came to hand, and the range of plant-life represented was likewise wide. Valuable sets of algae, fungi, hepaticae, musci, pteridophyta, and spermatophyta were added. Particularly valuable sets of plants came from the Philippine Islands and neighboring regions and from Canada, the United States, and the West Indies. Current exsiccati containing plants from nearly all parts of the world and representing all different plant-groups were received.

The accession of the W. R. Gerard herbarium and the fungous and moss portions of the Lucien M. Underwood herbarium materially enhanced the value of the collections.

Many specimens were collected or received from other collections for the local herbarium, that portion of the herbarium containing the plants growing naturally within a radius of one hundred miles of New York City. The local herbarium of flowering plants was renovated, rearranged, and completely written up. Much work, also, was accomplished on the collections of the lower groups of plants.

Two valuable sets of published illustrations were added to the herbarium: (1) nearly 500 printed plates and drawings from the Flora of Brazil, received as an exchange from the Berlin Botanic Garden and (2) about 175 printed plates representing the sapodilla family, received as an exchange from the Natural History Museum, Paris.

Selections from the specimens received during the year and from those previously received were mounted and made available for use. About 30,750 sheets of mounting paper were used and thus fully 46,000 specimens were incorporated in the permanent collections. In addition to these, several thousand bulky specimens, such as most of the fungi, fruits, seeds, and other parts of plants not suitable for pressing or for mounting with pressed specimens, were filed away in cardboard boxes.

Specimens received for the Columbia University herbarium were mounted and distributed in the cases.

Investigations and Assistance

A brief record is here made of some of the activities of the members of the curatorial staff, in addition to their regular herbarium work.

Dr. P. A. Rydberg, Curator, continued in charge of the collection of flowering plants. He completed the manuscript of monographs of the families Lennoaceae, Pyrolaceae, and Ambrosiaceae begun last year. The first and second of these families have been published in *North American Flora.* Work on the large family Rosaceae, which was in course of preparation and publication for the past several years, was completed, and the last part is now ready to print. Early in the year, Dr. Rydberg began a study of the family Carduaceae, and descriptions of a part of this family have been completed and have been published in *North American Flora.* Investigations on the above groups of plants, supplementary to those carried on at the Garden, were prosecuted at the herbarium of Harvard University and at the National Museum. Dr. Rydberg published two papers dealing with the flora of the Rocky Mountains and two on species of the family Rosaceae. He delivered one lecture in the Garden lecture course.

Dr. Marshall A. Howe, Curator, continued to devote his attention to the collections of algae and hepaticae. He concluded a study of and published a report on an extensive collection of marine algae from Peru,* this publication being partly paid for by a grant from the Peruvian Government. He also printed, exclusive of reviews, two papers on North American algae. The results of an investigation of fossil calcareous algae from the Panama Canal Zone remain unpublished. Following the annual meetings of the American Association for the Advancement of Science and of the Botanical Society of America, held in

* Memoir 15 of the Torrey Botanical Club.

Atlanta, Georgia, which he attended as a delegate from the Garden, Dr. Howe spent the first two weeks of the year in making collections of Ricciaceae in Georgia and of marine algae in Florida, a brief account of which operations have been published in the Garden *Journal*. In connection with his studies of the North American Ricciaceae, a collection of living plants, embracing twenty or more species, has been established in the propagating house. Dr. Howe continued his studies in the hepaticae and the algae in connection with work on *North American Flora*. He continued to act as an associate editor of the publications of the Torrey Botanical Club, and gave three lectures in the Garden lecture course.

Dr. Fred J. Seaver, Curator, has had general oversight of the fungous collections, and has published during the year several papers which are preliminary to monographs for *North American Flora*, besides delivering two lectures in the Garden lecture course. During summer and autumn, he devoted some time to the study and collection of the local fungi, especially the fleshy discomycetes. The large collection of fungi (including lichens) recently obtained from the Underwood Estate has been incorporated into the herbarium under Dr. Seaver's supervision. He has also continued his studies of local insect pests, and has assisted with the editing of *Mycologia*.

Mr. Percy Wilson, Associate Curator, devoted considerable time to the determination and distribution of various collections of plants received during the year from tropical America, especially from the West Indies. He also gave much attention to the study and rearrangement of the local flora collection of flowering plants. The Saturday afternoon public lectures between April and December were under his supervision. Mr. Wilson acted as docent three afternoons each week and took charge of all extra visiting classes applying for instruction. He also arranged for all photographic work and curated the photographic negative and lantern-slide collections.

Dr. Francis W. Pennell was appointed Associate Curator in September. He has been occupied in general herbarium work, and has continued investigations on certain groups of the figwort family, in addition to working on the bibliography of the whole family preliminary to a monograph of it for *North American Flora*. Dr. Pennell also incidentally studied portions of the collections of flowering plants from the southern states which were made on several exploring expeditions through that region.

Miss Margaret Slosson, Assistant Curator, devoted her time to the care and development of the collection of ferns and fern allies. She added valuable specimens to the herbarium by means of exchanges in this country and abroad, and presented her own fern herbarium to the Garden, selecting many of the rarer kinds from it for permanent incorporation in the Garden herbarium, and using the remainder as duplicates for exchanging. Miss Slosson published two papers on American ferns, and made progress on some monographic work for *North American Flora*.

Dr. H. H. Rusby, Honorary Curator of the Economic Collections, continued to develop the collections of the Economic Museum. For details, see his report.

Mrs. E. G. Britton, Honorary Curator of Mosses, continued to care for and develop the collection of mosses, with the assistance of Mr. R. S. Williams. Her report appears elsewhere in this publication.

Dr. Arthur Hollick, Honorary Curator of Fossil Plants, continued, with the assistance of Mr. Edwin W. Humphreys, the work he initiated in former years. For particulars, see report of the Honorary Curator of the Collection of Fossil Plants.

Early in the year, I pursued supplementary studies on the families Monotropaceae and Ericaceae at the National Museum and at the herbarium of Harvard University. The monographs of these families were published about the middle of the year. Preliminary work on other families for *North American Flora* was initiated. Considerable

time was spent in the determination of specimens from the local flora region and from the West Indies. I continued studies on the collections made on recent expeditions to southern Florida and on collections sent from that region by correspondents; and endeavored to increase the value of the collections of flowering plants through the aid of local collectors and students and by the addition of rare, recently naturalized, and newly described species from the south-eastern United States.

Respectfully submitted,

JOHN K. SMALL,

Head Curator of the Museums and Herbarium.

REPORT OF THE HONORARY CURATOR OF THE ECONOMIC COLLECTIONS

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to submit the following report for the year 1914.

Among the 195 specimens which have been added to our collections during the past year, there are several sets or groups which are worthy of special mention. The most important of these is a complete set of the fiber products of the Philippine Islands, donated by Mr. Theodore Muller, a graduate student of Columbia University. The collection represents every fiber produced in the Philippines that is in actual use in native or foreign manufacturing. It is accompanied by an enormous chart upon which the names of the fibers are not only listed, but elaborately classified as to origin and use. Ample spaces are furnished, in connection with each name, for attaching the respective sample to the face of the chart. The entire work, which is unique in character, is a labor of love on the part of Mr. Muller. By an expenditure of $100, it would be possible for us to supplement this collection with another, containing all the native products made from these fibers, and it is recommended that an appropriation be made for this purpose.

The American Sugar Refining Company, to whom we are

indebted for the larger part of our sugar collections, has recently made a number of additional contributions and has also replaced with fresh material some specimens which had deteriorated with age. There are thirty-two specimens, in all, in this donation. We have received from Dr. Carlos Manuel Asensi, of Calamo, Brazil, a partial set of Brazilian rubbers, together with samples of the raw milk and of the implements employed in rubber collecting and curing. The last mentioned articles are of special interest and value to our museum and we have for years past desired that they might be obtained.

A number of timber products, otherwise difficult and expensive to obtain, were donated by various exhibitors at the Forestry Exhibition held in Grand Central Palace in this City last summer.

Through the expedition of Dr. J. N. Rose, of the National Herbarium, to the west coast of South America, we have obtained a number of very rare food products. In addition to the samples of foods themselves, Dr. Rose has supplied living roots of the plants yielding them, which are now growing luxuriantly in our economic plant collection.

The accumulation of miscellaneous materials has continued throughout the year, and, as was the case during 1913, these have included quite a number of rarities among foods and drugs.

Respectfully submitted,

H. H. Rusby,

Honorary Curator of the Economic Collections.

REPORT OF THE HONORARY CURATOR OF MOSSES

Dr. N. L. Britton, Director-in-Chief.

Sir: I was a member of the expedition to Porto Rico during February and March and collected mosses and hepatics, and such lichens and fungi as were readily found, also taking care of the collections of the flowering plants while the rest of the party were off exploring Mona and Desecheo Islands. The collection of mosses made on the

Sierra de Naguabo, March 7–9, and those subsequently collected by Dr. Shafer in July and August, proved of great interest and have been studied and incorporated in the herbarium. A hand list of the mosses of Porto Rico has been prepared, including 71 genera and 165 species, with their habits and ranges throughout North America. It would appear from a comparison with the flora of Jamaica that either there is still more exploration necessary in the eastern and central mountain ranges of Porto Rico or the moss flora is less rich in species and genera, since 121 genera and 277 species have been listed from Jamaica.

The hepatics from this year's collection have also been prepared and listed, and 158 packets sent to Dr. A. W. Evans, of Yale University, for study. Mr. W. C. Fishlock, of the Agricultural Experiment Station at Tortola, in the Virgin Islands, has been stationed on Dominica for a few months and has very kindly sent us a small collection of mosses and hepatics from that island. Mr. William Harris, of Hope Gardens, Jamaica, Mr. W. E. Broadway, of Tobago, and the Christian Brothers, of La Salle College, Cuba, particularly Brother León, have continued to send us duplicates for our sets of West Indian Exsiccati, which we hope to distribute at an early date.

During late winter and early spring, a series of essays and compositions on the "Preservation of Our Native Plants" was received from the high schools of Greater New York and the public schools of The Bronx, and selections from these were printed in the Garden *Journal* as Stokes Prize Essays, each of the schools receiving a framed picture of eight colored illustrations of wild flowers in special danger of extermination in this region. I have also acted as secretary-treasurer of the Wild Flower Preservation Society of America.

Mr. Williams, Administrative Assistant, has finished his studies of the Philippine mosses and published his enumeration in the *Bulletin*. He has also devoted considerable time to studying collections received from the National

Museum in Washington and from Yale University, and has assisted me in the determination of some of the more difficult species of West Indian mosses. During the year, large collections from Bolivia, the Philippine Islands, and Porto Rico, a total of over 4,700 specimens, have been added to the herbarium, and exchanges have been conducted with various institutions and collectors.

Respectfully submitted,
ELIZABETH G. BRITTON,
Honorary Curator of Mosses.

REPORT OF THE HONORARY CURATOR OF THE COLLECTION OF FOSSIL PLANTS

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to report as follows on activities in connection with the collections of fossil plants for the year 1914.

The principal routine work has been the cataloging of the type and figured specimens, which was begun several years ago. About 1,800 specimens have been cataloged to date, each one on a separate card. When finished, this will constitute a complete list and index which will be of great value for ready reference, and may be printed and distributed for the information of those who may be interested in knowing where these specimens are located. The prosecution of the work is in charge of Mr. E. W. Humphreys, under my advice and direction.

A large part of my time has been occupied in studying and reporting upon collections of fossil plants sent to me from various sources. Among these may be mentioned the following: Tertiary plants from Japan, sent by Professor H. Yabe, of the Geological Institute of the Imperial University, Sendai, Japan; Tertiary plants from the Mount McKinley region, Alaska, sent by Dr. F. H. Knowlton, of the U. S. Geological Survey; Pleistocene plants from the Kootenay Valley, British Columbia, sent by Mr. R. W. Brock, of the Canada Geological Survey; and Pleistocene

plants from the Don River Valley, Ontario, sent by Professor J. H. White, of the University of Toronto. In each instance duplicate specimens have been secured for the Garden collections in return for the work performed.

About 50 specimens have been accessioned, labeled, and arranged in their proper cases, while a number of others are awaiting identification and future study. Mr. Humphreys is assisting in this work.

A number of manuscript labels have been replaced by printed ones. Copy for all of the former that yet remain has been transmitted to the printer and as fast as the printed ones are received they will be installed.

One student has received instruction in paleobotany under my direction; and I had the privilege of delivering two lectures on paleobotanical subjects in the regular Saturday afternoon courses. Every effort was made by means of exchange of publications to add to the paleobotanical library, and thirty-two volumes and pamphlets were thus secured.

Respectfully submitted,

ARTHUR HOLLICK,

Honorary Curator of the Collection of Fossil Plants.

REPORT OF THE DIRECTOR OF THE LABORATORIES

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to submit the following report for the year 1914.

The Laboratories

No essential change has been made in the arrangement or the equipment of the laboratories from that of the previous year. The full quota of microscopes has been in use almost continuously during the year. To supply fully the needs in this line, it may be desirable to purchase one more microscope during the coming year.

Experimental Garden and Greenhouses

The facilities of the experimental garden and greenhouses have been utilized fully during the year. For student

investigations in genetics and pathology, a considerable number of plants have been grown, especially of *Abutilon*, *Phlox*, *Nicotiana*, *Hordeum*, *Triticum*, *Mercurialis*, *Matthiola*, *Hicoria Pecan*, and *Zea Mays*. Corn was grown for genetical study by Professor R. A. Harper. Besides these, plants were grown for my own investigations. The growing of plants of special interest to students of heredity has also been continued.

Miscellaneous Duties

The records of rainfall and temperature at the Garden have been taken and monthly summaries of the same prepared for publication in the Garden Journal. As secretary of the conferences of the scientific staff and students of the Garden, I have planned programs for the various monthly conferences. During the past year, I have also continued as editor of the Garden *Journal*.

Personal Investigations

Progress has been made in the various personal investigations mentioned in my report of last year. Plants of the second generation of various crosses between types of *Cichorium Intybus* were grown during the year and considerable data obtained regarding the behavior of self sterility and the inheritance of flower color, number of flowers, and shape of leaves.

The studies with *Verbascum Blattaria* have been somewhat retarded by the unexpected winter-killing of about 2,000 plants. New plantings were made in the spring and a considerable number of plants forced into bloom as annuals. Those remaining over the present winter have been mulched in an attempt to prevent winter-killing. Two cases of wide variations or mutations in *Verbascum* appeared during the summer. In one case, the plant was much branched, with abundant proliferation from the ovaries. In the other case, the branches were long, slender, and somewhat twining, and the flowers were small

and almost entirely cleistogamous. Seed progeny of these will be grown to test the inheritance of these variations.

The severe winter of 1913–1914 killed about 1,500 plants of *Hibiscus*, thereby interfering with the breeding experiments in this genus. New plantings were again made to cover the various lines of experiments planned. A considerable number of these young plants bloomed late in the season and I was able to obtain some seed for a new generation. Several new types have appeared in the cultures. One which is of special interest appears to be a dwarf mutant of the species *Hibiscus oculiroseus*. It was also determined that the first generation hybrids between white-flowered forms of *H. Moscheutos* and *H. oculiroseus* were almost identical to the latter in flower color, but different in pod character.

Certain phases of the study of bud-variation in *Coleus* have been completed and the results are now prepared for publication. These investigations will be continued and somewhat extended, especially in regard to the behavior of seed progenies.

First generations of hybrids involving several species of *Carex* are now growing and should bloom during the coming year.

During the spring, data were taken on variations that appeared in the different types of tulips grown for display here. A bed of tulips derived from bulbs of plants showing variation has been planted in the experimental garden for further special observation.

The winter months have been employed in working up data and in pursuing cytological studies.

The appointment of Miss Helene Boas as laboratory assistant has aided the progress of various investigations. Miss Boas has been given charge of the statistical data regarding the inheritance of flower number in *Cichorium*. She has also made a general survey of the variegated plants grown here with special reference to the types and to their distribution in various families.

I spent the time between July 11 and August 22 in a trip to Germany, Holland, and England, an account of which was printed in the November issue of the *Journal.* During my absence, my experimental work was ably prosecuted by Mr. Allen C. Fraser under a scholarship grant, while Miss Boas, assisted by Miss Friedolina Jud, collected statistical data pertaining to *Cichorium.*

Students and Investigators

The following is a list of the students and investigators formally registered at the Garden during the past year.

*Altenberg, Edgar. A.M., Assistant in botany, Columbia Univ.
Heredity of Althaea rosea and of various cereals.

†Barbour, William Clay. B.S., Assistant teacher of biology, High School of Commerce.
Lichenology.

*Cameron, Walter S. A.M., Instructor of biology, Wadleigh High School.
Mosaic disease of tobacco.

†Fink, Bruce. Ph.D., Professor of botany, Miami University.
Morphology and taxonomy of Ascomycetes.

†*Fraser, Allen Cameron. B.S., Instructor in genetics, Cornell Univ. since September, 1914.
Heredity in Phaseolus and Aquilegia.

Gordon, Robert Charles. A.B., Miami Univ., '14. Teacher in public schools, New York City.
Taxonomy of the Lecidiaceae of Ohio.

Graham, Margaret Alexander. Ph.D., Instructor in biology, Teachers' College.
Cytology of Hepaticae.

*Jud, Friedolina Catharina. A.M.
Palaeobotany. Geology.

†Kauffman, Calvin Henry. Ph.D., Assistant professor of botany, Univ. of Michigan.
Mycology; the genus Cortinarius.

* Registered at Columbia University.
† Research scholarship.

KELLY, JAMES P. A.M., Columbia Univ., 14. Instructor of botany, State College, Pennsylvania, since September, 1914.
Genetics: heredity of Phlox Drummondii.

†McCORMICK, FLORENCE ANNA. Ph.D., Assistant professor of agricultural botany, Agric. Exp. Sta., Lincoln, Nebraska.
Cytology of the Mucorales.

*MULLER, THEODORE.
Pathology: etiology of corn smut.

*†NELSON, EDGAR. A.B., Assistant pathologist, Agric. Exp. Sta., Florida.
Pathology.

*RAND, FREDERICK VERNON. M.A., Assistant pathologist, Bureau of Plant Industry.
Pathology: rosette of the pecan.

REID, KATHERINE WILLESS. A.M.
Variegation in Abutilon and Ligustrum.

*STEWART, ELEANOR GRACE. B.S., Science teacher, Miss Chapin's School for Girls, New York City.
Cytology of the cacti.

*STEWART, RALPH RANDLES. A.B., Assistant in botany, Columbia Univ.
Taxonomy of the phanerogams of western Tibet.

*STOWELL, WILLARD ALLEN. B.S., Instructor in science, High School, Elizabeth, New Jersey.
Cytology, genetics.

*STURTEVANT, ALFRED H. Ph.D., Columbia Univ., 14.
Genetics; heredity in Pisum.

*YAMPOLSKY, CECIL. B.S.
Cytology, genetics.

In addition to those mentioned in the above list, numerous investigators have utilized to some extent various facilities for research at the Garden.

Respectfully submitted,

A. B. STOUT,
Director of the Laboratories.

* Registered at Columbia University.
† Research scholarship.

REPORT OF THE BIBLIOGRAPHER

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to submit the following report for the year 1914.

Assistance of those seeking information in the Garden library has occupied much of the Bibliographer's time; increasingly so as this function of his office has come to be appreciated by users of the library. The variety of information sought is as wide as the field of botany and horticulture. Of course, some of the problems presented remain unsolved, but these are relatively very few. At the same time bibliographic research has been continued, and the various manuscript records that have proved useful for reference in the bibliographic work have been further developed.

After an interval of a year and a half or more during which funds for the purpose were not available, the Garden was once more in a position to enlarge the representation of the older botanical literature in our library, when the breaking out of the European war rendered the usual channels of trade unsafe; consequently few books have been purchased from abroad. By far the most important accession of the year was the botanical library of the late Professor Lucien M. Underwood, purchased with his collection of fungi, in July. This contained some works not previously represented, and even the duplicates were useful in the development of much-needed departmental libraries, which are placed near the collections to which they more especially relate.

Three parts of *North American Flora* have appeared during the year: Volume 10, Part 1, in July, Volume 29, Part 1, in August, and Volume 34, Part 1, in December. In the case of the first, the very careful and efficient attention of the author to details, greatly lightening the usual burdens of the bibliographer, is here gratefully acknowledged. Of the *Flora*, eleven volumes are now in course of publication, and of one of these, five parts have appeared.

A beginning has been made on all of the larger groups of plants except the Algae.

In addition to routine duties, two lectures have been given in the public courses of the Garden; and one of these was repeated before the Torrey Botanical Club.

Respectfully submitted,

JOHN HENDLEY BARNHART,

Bibliographer.

REPORT OF THE LIBRARIAN

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to submit the following report for the year 1914.

According to a census of the library taken at the end of the year, the number of bound volumes was found to be 26,299, an increase of 923 volumes since the report for 1913.

During the year, 472 books have been bound, including 36 which are the property of Columbia University.

Among the accessions are 361 books acquired by purchase, 47 by exchange and deposit, and 27 by gift.

The books and pamphlets forming the library of the late Professor Lucien M. Underwood, which were purchased in July, have been shelved and partly cataloged. A more complete account of this collection may be found in the November number of the *Journal*.

In accordance with the agreement between Columbia University and the New York Botanical Garden, 50 books were permanently withdrawn by the former institution during the past year. Some of these have been replaced by books from the Underwood collection.

Since the outbreak of the war in Europe there has been a noticeable decrease in the number of periodicals received from abroad, with the exception of England. In some cases, statements have been received from the publishers to the effect that no more numbers of their periodicals would be issued for a time.

The number of cards written during the past year is 3,204.

In March, letters were sent out to certain librarians and library schools making inquiry regarding the legibility, durability, and economy of typewritten cards as compared with handwritten ones. The verdict was unanimous in favor of the use of the typewriter and the statement was made, among others, that "It would be extravagant to have a handwritten catalog in an institution of any size." It is earnestly hoped that the library may soon be supplied with a typewriter, in order that the hundreds of books and pamphlets awaiting cataloging may be made more readily available to our readers.

The following publications should be added to the list of those received regularly by the Garden, which appeared in the Bulletin (**7**: 325–347) and was supplemented in later reports (Bulletin **8**: 45, 213, and 293).

American Journal of Botany. Brooklyn, New York.
Canada. Department of Agriculture. Ottawa, Canada. *Publications of the International Agricultural Institute.*
*Journal of Agricultural Science. London, England.
*Journal of Genetics. London, England.
*Journal of Heredity. Washington, D. C.
Le Naturaliste Canadien. Quebec, Canada.
Missouri Botanical Garden. St. Louis, Mo. *Annals* and *Bulletin* (replacing *Annual Report*).
Société Vaudoise des Sciences Naturelles. Lausanne, Switzerland. *Bulletin.*
Stockholm. Statens Skogsförsöksanstalt, Stockholm, Sweden. *Meddelanden.*
Tasmania. Royal Society of Tasmania. Hobart, Tasmania [*Publications*].
Tree Talk. Stamford, Conn.

Respectfully submitted,

SARAH H. HARLOW,
Librarian.

REPORT OF THE SUPERINTENDENT OF BUILDINGS AND GROUNDS

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to submit the following report for the year 1914.

Regulating and Grading

This work has been accomplished in many parts of the Garden. In front of conservatory range 2, we removed about 2,800 yards of earth which was used to grade along the eastern boundary fence, for a path around the western side of this range, for filling the bayou south of the boulder bridge and for filling at the northern side of the long bridge. The bayou at the sewer syphon was filled in to the grade of the north meadows, about 125 yards of earth being here used. About 150 yards of top-soil were used to fill in and grade the ground west of the syphon. We graded the north meadows with about 150 yards of top-soil. Both sides of the upper bridge were graded with 75 yards of top-soil.

The sod border was lowered along the edges of the roads at the west end of the long bridge, the north end of the lake bridge, the west side of the museum building, and on the truck road from 200th street entrance to the elevated railway approach.

The lowlands north of the woodlawn road approach were filled in with 2,400 yards of earth by contractors working in the vicinity of the Garden who wanted a convenient place to dispose of it.

About 3,000 yards of earth, 900 yards of top-soil, and 350 yards of stone were removed. The stone was used to complete the path through the pinetum and paths on the eastern side of the river. This stone was also used for liners of paths north of the sewer syphon and for paths around conservatory range 2 and power house 2.

Drainage

A catch-basin was built on the western driveway to dispose of the surface water north of the Mosholu Parkway approach. To do this, 36 feet of 4-inch drain-pipe were used. We extended the surface drain north of the long bridge, using 38 feet of 6-inch pipe, and the drain pipe at the syphon, using 57 feet of 12-inch pipe. In connecting power house 2 with the surface drain, we used 110 feet of 12-inch pipe.

There is now in the course of construction an 8-inch branch connected with this 12-inch drain, which is to drain the bottom of the trench of power house 2. About 108 feet of this branch is laid and covered.

Paths

A path 10 feet wide and 617 feet long was completed ready for trap-rock screenings through the pinetum to the flower gardens at the eastern entrance of conservatory range 1. On the east side of Bronx River, near the syphon, we have completed a 10-foot path 655 feet long with a spur of 90 feet, and this is also ready for screenings. We have also dug and laid line-stones for a path 303 feet long with a spur of 127 feet, on the east side of the river near the syphon, and this is now ready for paving.

A 10-foot path 814 feet long, with two branch paths 8 feet wide and 61 feet long, has been graded on the east side of conservatory range 2, and a 10-foot path 135 feet long has been graded on the west side of this range. We also have ready for paving a 10-foot path 90 feet long at power house 2. All the line-stones for paths around conservatory range 2 are laid ready for paving.

Buildings

Many repairs were made to the roof of the museum building this year. On the west side of the walk to the museum building, the balustrade was rebuilt for a distance of 50 feet; and a 20-inch ventilator was built over the steam trench on the terrace in front of the west wing of the museum building.

In addition to the usual repair work, the carpenters built two herbarium cases, extended shelving in publication storage rooms, made a pair of doors for the main entrance to the museum building, two pairs of doors and six large sashes for the vestibule at conservatory range 1, two cold frames near the propagating house, fourteen rustic cedar benches, and a hay barrack that will hold twenty-five tons

of hay. The east wing of the first floor of the museum building, the propagating house, and all the doors of both conservatory ranges have been repainted. The Fordham University fence, the fence at the eastern boundary of the Garden, and all guard-rails have also been painted. All broken glass at the two conservatory ranges and the propagating house was replaced by the painter.

The boiler at power house 2 has been reset and all the brickwork has been taken down and rebuilt. The steam engineers have made all necessary repairs to our steam system. All needed repairs to the gas and water systems were made and the stonework at both public conservatories was pointed with cement mortar by our employees.

Grounds

During the summer months, from June to September, we have had five city officers on Saturdays, Sundays, and holidays, and, with two regular keepers and twelve additional guards selected from gardeners and laborers, the grounds have been well protected. At all other times during the year, only one city officer is detailed for the Garden. The number of visitors on Sundays and holidays during the warm weather averaged about 30,000, but this number was greatly increased in July. Owing to the vigilance of our employees, little damage was done to the lawns and plantations this year.

By using the gasoline engine for fourteen days, we cut enough wood to supply the propagating house with wood for five months. About 40 tons of hay were cut. We have continued the uprooting of poison ivy throughout the grounds, making considerable progress, and this work will be continued until the ivy is exterminated.

The expenditures for lawn mowers, the purchase of a horse, the feeding and shoeing of horses, and repairs to wagons amounted to $1,434.27.

Guard-rails

Along the bank on the western side of the Bronx River near the water-fall, we have built a one-inch iron-pipe fence 3 rails high and 350 feet long, and a one-inch iron-pipe fence 2 rails high and 250 feet long. At conservatory range 1, a fence 113 feet long, 1 rail high, was erected. At the elevated railway approach, 300 feet of one-inch fencing 2 rails high were built and 80 feet of a one-inch fence, 1 rail high, were constructed near the New York Central Station. Near conservatory range 1, 2,256 feet of three-quarter-inch pipe, 1 rail high, were erected, and 391 feet of the same kind of guard-rail were put up along the path paralleling the Fordham University fence.

Respectfully submitted,

ARTHUR J. CORBETT,

Superintendent of Buildings and Grounds.

SCHEDULE OF EXPENDITURES DURING THE YEAR 1914

1. CITY MAINTENANCE ACCOUNT

Appropriated $107,163.00

Expended		
Personal Service		
Salaries	$80,563.50	
Labor	7,996.12	
Total		$88,559.62
Sundry Expenses		
Forage	$ 783.17	
Fuel	10,213.87	
Supplies	1,618.60	
Equipment	2,112.38	
Materials	1,911.59	
Repairs	979.64	
Telephone Service	122.26	
Contingencies	861.87	
Total		$18,603.38
Total Expended		$107,163.00

2. CONSTRUCTION AND EQUIPMENT

1911 Account

Erection of an additional Greenhouse.

January 11, 1915, Balance	$ 120.11

1913 Account

Retaining Walls, Woodlawn Avenue Bridge.

January 10, 1914, Balance	$ 78.51
Rescinded, January 23, 1914	78.51

3. SPECIAL GARDEN ACCOUNTS

EXPLORATION FUND

1901 to 1913. Subscriptions	$37,028.45	
Sales and Refunds	1,669.06	
Total		$38,697.51
1901 to 1913. Expended		38,673.46
Balance		$ 24.05

MUSEUM AND HERBARIUM FUND

1901 to 1913. Subscriptions	$11,885.00	
Sales and Refunds	387.89	
1914. Subscriptions	10.00	
Total		$12,282.89
1901 to 1913. Expended		12,263.99
Balance		$ 18.90

PLANT FUND (CONSERVATORY FUND)

1900 to 1913. Subscriptions	$ 8,326.55	
Sales and Refunds	561.96	
1914. Subscriptions	1,250.00	
Sales and Refunds	91.20	
Total		$10,229.71
1900 to 1913. Expended	$ 8,569.69	
1914. Expended	1,493.84	
Total		$10,063.53
Balance		$ 166.18

SPECIAL BOOK FUND

1899 to 1913. Subscriptions	$27,722.88	
Sales and Refunds	121.48	
1914. Subscriptions	3,825.00	
Total		$31,669.36
1899 to 1913. Expended	$27,832.36	
1914. Expended	3,737.36	
Total		$31,569.72
Balance		$ 99.64

SUMMARY OF SPECIAL GARDEN ACCOUNTS

Subscriptions

1899 to 1913	$84,962.88	
1914	5,085.00	

Sales and Refunds

1899 to 1913	$ 2,740.39	
1914	91.20	
Total		$92,879.47

Expended

1899 to 1913	$87,339.50	
1914	5,231.20	
Total		$92,570.70
Balance		$ 308.77

4. CHARLES FINNEY COX MEMORIAL FUND

1912 and 1913. Subscriptions	$	5,075.00
Expended		5,068.10
Balance	$	6.90

5. SPECIAL INCOME ACCOUNTS

	Appropriated	*Expended*	*Balances*
Income of Lydig Fund			
Publications	$ 3,000.00	$ 2,975.99	$ 24.01
Income of Mills Fund			
Exploration	2,300.00	2,288.08	11.92
Income of Henry Iden Fund			
Resident Research Scholarships	440.00	337.50	102.50
Income of Wm. R. Sands Fund			
Horticultural Prizes	400.00	352.00	48.00
Income of Stokes Fund			
Preservation of Native Plants	120.00	105.25	14.75
Income of Addison Brown Fund			
(To accumulate)	1,400.00		1,400.00
Income of John Innes Kane Fund			
Plants for Grounds and Greenhouses	300.00	288.20	11.80
Income of Students Research Fund			
Aid for Students Research	150.00	100.00	50.00
Income of Science and Education Fund			
Plants, Specimens and Books	3,000.00	2,403.32	596.68
Totals	$11,110.00	$ 8,850.34	$ 2,259.66

6. GENERAL INCOME ACCOUNT

	Appropriated including Transfer	*Expended*	*Balances*
Museums and Herbarium	$ 600.00	$ 600.00	$ ——
Laboratories	460.00	416.27	43.73
Lectures and Lantern Slides	575.00	573.73	1.27
Photography	620.00	614.57	5.43
Publications	840.00	833.95	6.05
Investigations at other Institutions	800.00	799.59	.41
Circulars for Membership	350.00	324.02	25.98
Insurance	500.00	489.72	10.28
Supplies (including binding)	1,900.00	1,884.23	15.77
Contingent Fund	630.00	629.98	.02
Entertainment	325.00	306.95	18.05
Assistance for Treasurer	480.00	480.00	——
Special Assistance	900.00	873.75	26.25

Salaries	11,205.00	11,190.00	15.00
Labor	2,900.00	2,866.27	33.73
Totals	$23,085.00	$22,883.03	$ 201.97

7. SUNDRIES

Miscellaneous	$ 620.64

8. EXPENDED FROM FUNDS OF THE GARDEN

Special Garden Accounts for 1914	$ 5,231.20
Special Income Accounts	8,850.34
General Income Account	22,883.03
Sundries	620.64
Total	$37,585.21

Respectfully submitted,
WALTER S. GROESBECK,
Accountant.

E. and O. E.
NEW YORK, January 11, 1915.

REPORT OF THE CHAIRMAN OF THE SCIENTIFIC DIRECTORS

To the Board of Managers of the New York Botanical Garden.

Gentlemen: I have the honor to submit the following report from the Scientific Directors for the year 1914.

We have held the four stated meetings of the year, which have been well attended. At one of them, we had the pleasure of the company of our President. At our last meeting, Provost Carpenter, of Columbia University, was present as the accredited representative of President Butler, and we understand that we may look for his presence in this capacity at our future meetings.

The only change in the personnel of the staff since our last report, is the appointment of Dr. Francis W. Pennell, as Associate Curator, to succeed Dr. Robinson, deceased. The readjustment of salaries which was accomplished last year has fully justified itself and has been a source of great satisfaction to all concerned.

The work under our charge has proceeded steadily and is of the usual volume and character; some of it of exceptional importance.

First in importance, probably, is the expedition to the West Andean region, for the study and collection of Cactaceae, undertaken in cooperation with the Carnegie Institution of Washington and the United States Department of Agriculture. This work has been executed as proposed to you in our last report, except that Dr. J. N. Rose, of the National Herbarium, who is associated with Dr. Britton in this study, found it possible to make the journey himself, instead of sending Dr. Shafer. Mrs. Rose accompanied and assisted her husband in his difficult and laborious undertaking. The results, from a scientific standpoint, are of the richest description. It is believed that most of the species of Cactaceae growing on the Pacific side of the Andes are now represented in our collection, both

in the dried and growing condition. Most of these species have not previously been known in cultivation. Some of them, and probably one or more genera, are new to science. We take great satisfaction in the receipt of this splendid addition to our collections, especially in view of its usefulness in contributing to the monograph of the family, upon which we are now engaged.

Among the explorations of the year has been one by the Director-in-Chief, accompanied by Mrs. Britton and Dr. Shafer, to Porto Rico. Dr. Shafer visited also the neighboring island of Vieques. This work was performed in connection with the natural history survey of Porto Rico, in which we are associated with the New York Academy of Sciences. Another expedition was made by Dr. Britton to the Bermudas. A short excursion was made by Dr. Howe to the coasts of Georgia and Florida, for the study of marine algae.

Advantage has been taken of the presence in this country of Dr. N. Wille, Professor of Botany in the University of Christiania, Norway, and probably our highest authority on fresh-water algae, to employ his services in the collection and study of these plants in Porto Rico and in the vicinity of New York.

Dr. Stout, Director of the Laboratories, has made a somewhat extended visit to various European laboratories in the interest of his studies in heredity and plant breeding. This work, which has occupied Dr. Stout for several years, and in which he has interested a number of his students, deals with fundamental laws of plant growth and development and is yielding results which appear likely to modify existing views of the relations between sexual and vegetative inheritance in plants. It is to be deplored that the Garden is not likely to be in a position to publish the results of these studies, which will be quite expensive, owing to the necessity for colored illustrations.

In reporting the continued growth, in circulation and influence, of the Garden publications, we would direct

your special attention to the care that has been exercised in maintaining the scientific and literary standards under which they were established.

In addition to our regular periodicals, we have published three parts of *North American Flora.*

There has also appeared a paper by Mr. Williams on Philippine mosses, based chiefly on the results of study of his own collections in those islands.

Reference should here be made to the publication, in recent numbers of the *Journal*, of the symposium of lectures of 1913 on Vegetable Foods. Almost every phase of the subject is treated in these publications, which render the 15th volume of the *Journal* of exceptional interest. In the July number of the *Journal*, is printed in form for convenient reference, our Act of Incorporation, Constitution, By-Laws, Regulations for the Office of Director-in-Chief, Provisions for Contributing Membership, and Provisions of the Charter of the City of New York for Maintenance.

Although not actually published by the Garden, an important paper by Dr. Howe on the "Marine Algae of Peru," which forms the 15th volume of the *Memoirs of the Torrey Botanical Club*, should here be mentioned. This work was performed by Dr. Howe in association with the Peruvian Government.

The contemplated publication of a new edition of the Garden "Guide Book" was found unnecessary at this time, owing to the return to us of several hundred unused copies which had been supplied to the Hudson-Fulton Celebration Committee. The work on our local flora by Mr. Norman Taylor, referred to in our last report, is nearly completed and its publication is looked for during the early part of the coming year. Dr. Britton's work on the flora of Bermuda is also almost ready for publication.

Arrangements have been completed for the publication of a sample number of our new periodical, with colored illustrations, provided for by the Addison Brown bequest.

This number is to serve as a prospectus, to be used in securing subscriptions to the publication.

The additions to our collections during the past year have been large and varied. They are discussed in detail in the reports of the several departments. Special reference may be made in this connection to our acquisition by purchase of the residuum of the library and herbarium of the late Professor Underwood. Among these collections are 17,000 specimens of fungi, which constitute a welcome addition to our already large mycological collections.

Our student investigations, pursued under the supervision of the Director of the Laboratories, represent the usual range of subjects, although studies in cytology and heredity largely predominate. Considerable work on the pathology of certain groups has also been performed. In addition to this work by our regular students, many important researches have been carried on by visiting botanists, the year having been unusually prolific in this direction.

Cordial and active association with other institutions has been maintained. On October 15 and 16, we were represented by Dr. and Mrs. Britton at the 25th anniversary of the founding of the Missouri Botanical Garden. On January 2, Dr. Murrill represented us in Albany at the inauguration of Dr. Finley as head of the New York State Education Department, and later in the same month at the meeting of the New York State Forestry Association, in the same city.

An event of special interest was the 16th annual convention of the American Association of Park Superintendents, which convened in Newburgh and in this city. On the latter occasion, the Garden was one of the institutions visited. We were also represented at the Newburgh meetings.

The usual floral exhibitions and meetings of the New York Horticultural Society have been held in the museum building.

Our plans for cooperating with the Columbia University

School of Agriculture have been carried out, a half acre of Garden land having been utilized by that School for experiment and teaching, during the past season.

The proposed international botanical congress in London having been prevented by the European war, the question of joining in a movement to hold it in this country was taken up at one of our meetings. After full discussion of all the conditions and circumstances, it was deemed inadvisable to take such action.

At our December meeting, the opinion prevailed that we should take some steps to celebrate the 20th anniversary of the appropriation by the City of land for this Garden, which anniversary will occur next year. It was accordingly resolved that we should invite the botanists of the United States and the several botanical societies to meet with us during the late summer or early fall for this purpose.

In connection with the organization of the Women's Auxiliary, a spring inspection day was appointed on the 7th of May last, when the buildings and grounds were systematically inspected by the members of the Garden and their guests, to the number of some 300, and tea was served in the museum building. This proved to be a most enjoyable occasion. A spirit of the utmost cordiality was manifested and the occasion was one of the most pleasant in the Garden's history. Such entertainments are expected to become a regular feature of the Garden's future proceedings.

Four public courses of Saturday lectures have been given, seven in the spring, eight in the early summer, nine in the late summer, and seven in the fall. The attendance upon and interest in these lectures have shown so marked an increase that the desirability of instituting a winter course is now under consideration.

Besides these regular courses, two special lectures on "The Cultivation of Plants" were given by Mr. Nash to the school children of The Bronx, in connection with the Bronx Gardens Association.

The subject of increased decorative planting and continuous horticultural display has occupied much of our attention during the past year. It has long been our feeling that such a procedure would tend toward closer relations between ourselves and the general public and would extend our field of usefulness, as well as strengthen our own position. With the increased protection against robbery and vandalism afforded by our enclosing fences, the possession of the nucleus of a special fund donated by Mrs. John Innes Kane for such decorative planting, and the assistance of the Women's Auxiliary, which is likely to prove specially helpful to us in this direction, we feel that the time has come for the adoption of definite plans for such work. Its successful performance, however, will require the use of a larger sum than is available from our current funds, wherefore we have placed before you a request for action in this direction which we trust you will find practicable at some time during the coming year. A slight indication of the public reception that is likely to be accorded such displays as are intended, was afforded last spring by the throngs of delighted visitors who daily inspected our magnificent beds of tulips, our rose collections, and our waterlily tanks.

At the last annual meeting of your Board, announcement was made of the murder of our Associate Curator, Dr. Charles Budd Robinson, by the savage natives of Amboina. At our meeting of April 11 last, appropriate resolutions in memory of Dr. Robinson were incorporated into our minutes and it was resolved to establish a small fund, to be known as "The Charles Budd Robinson Memorial Fund," to be employed in aiding botanical exploration. In pursuance of this resolution, a fund amounting to over $650 has been secured by private subscription among Dr. Robinson's friends.

Respectfully submitted,

HENRY H. RUSBY,

Chairman of the Scientific Directors.

REPORT OF THE COMMITTEE ON MEMBERSHIP FOR THE YEAR 1914

To the Board of Managers of the New York Botanical Garden.

Gentlemen: The number of new members who have qualified is 67. The number of Annual Members is now 831; Life Members 151; Sustaining Members 17; Fellowship Members 6.

Of these, 34 are now in arrears for dues for 1914, 18 for dues for 1913 and 1914, and 9 for dues for 1912, 1913, and 1914.

Dues have been collected to the amount of $9,010. One person has qualified as a life member by the payment of $250. These sums have been transmitted to the Treasurer.

A complete list of all classes of members to date is herewith submitted.

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Columbia University,
*Hon. Chas. P. Daly,
*D. O. Mills,
*J. Pierpont Morgan, Sr.
John D. Rockefeller,
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*Deceased.

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Karl Eilers,
Henry G. Eilshemius,
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Wm. D. Ellis,
Miss L. F. Emmett,
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Jno. C. Eno,
R. Erbsloh,
Henry Esberg
Arthur F. Estabrook,
Louis Ettlinger,
A. W. Evarts,
Chas. S. Fairchild,

Samuel W. Fairchild,
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Walton Ferguson,
Pliny Fisk,
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A. M. Guinzburg,
Miss Delia L. Gurnee,
W. S. Gurnee, Jr.,
Mrs. Gurnee,
John A. Hadden, Jr.,
John M. Haffen,
Daniel S. Hage,
William Hague,
Hon. Ernest Hall,
Wm. Halls, Jr.
Miss Laura P. Halsted,
Wm. Hamann,
Miss Catherine L. Hamersley,
L. Gordon Hamersley,
Miss Adelaide Hamilton,
Miss Elizabeth S. Hamilton,
Ferdinand Hansen,
Chas. T. Harbeck,
Anson W. Hard,
J. Montgomery Hare,
E. S. Harkness,
Mrs. Frank D. Harmon,
Harry Harper,
S. W. Harriot,
William Hamilton Harris.
Jacob Hasslacher,
T. A. Havemeyer,
J. Woodward Haven,
Matthew Hawe,
Miss Caroline C. Haynes,
Mrs. W. R. Hearst,
Wm. W. Heaton,
Hancke Hencken,
Chas. Henderson,

Mrs. E. C. Henderson,
Harmon W. Hendricks,
Mrs. A. Barton Hepburn
B. F. Hermann,
Ferdinand Hermann,
Selmar Hess,
H. H. Hewitt,
Mrs. James J. Higginson,
Walter Hinchman,
J. Oakley Hobby,
B. Hochschild,
Mrs. H. P. Hodson,
Richard M. Hoe,
Mrs. Richard March Hoe,
Mrs. Robert Hoe,
Bernhard Hoffman,
Mrs. Edward Holbrook,
John Swift Holbrook,
E. R. Holden,
Henry Holt,
Hoole & Geiswein,
F. T. Hopkins,
William B. Hornblower,
Frederick B. House,
C. J. Housman,
M. D. Howell,
John Sherman Hoyt,
Theodore R. Hoyt,
Walter C. Hubbard,
Conrad Hubert,
Alex C. Humphreys,
Mrs. E. W. Humphreys,
Mrs. C. P. Huntington,
Adolph G. Hupfel,
Dr. Frank Hustace,
Frank DeK. Huyler,
Mrs. Clarence M. Hyde,
Henry St. John Hyde,
Dr. Edward J. Ill,
Adrian Iselin, Jr.,
C. Oliver Iselin,
Miss Georgine Iselin,
William E. Iselin,
Mrs. William E. Iselin,
Miss Flora E. Isham,
Samuel Isham,
Dr. Abram Jacobi,
Samuel K. Jacobs,
John S. Jacobus,
A. C. James,
Mrs. Arthur Curtis James,
Dr. Robert C. James,
E. C. Jameson,
Alfred W. Jenkins,
O. G. Jennings,
Walter B. Jennings,
Mrs. Maria de W. Jesup,
Mrs. Townsend Jones,
Karl Jungbluth,
Jos. L. Kahle,
Louis Kahn,
Mrs. Delancey Kane,
Miss Louise Landgon Kane,
Wilhelm Kaupe,
Mrs. H. F. Kean,
Frank Browne Keech,
Henry F. Keil,
Prof. J. F. Kemp,
Mrs. John S. Kennedy,
David Keppel,
Rudolph Keppler,
Mrs. Catherine L. Kernochan,
John B. Kerr,
Geo. A. Kessler,
Patrick Kiernan,
S. E. Kilner,
Alfred R. Kimball,
David H. King, Jr.,
Mrs. Wm. M. Kingsland,
Darwin P. Kingsley,

W. Ruloff Kip,
E. C. Klipstein,
Roland F. Knoedler,
Chas. Kohlman,
Louis Krower,
H. C. Kudlick,
Adolf Kuttroff,
Francis G. Landon,
Edward V. Z. Lane,
Woodbury Langdon,
Dr. G. Langmann,
Mrs. John J. Lapham,
Lewis H. Lapham,
F. F. Lathrop,
Countess de Laugier-Villars,
Mrs. Lauterbach,
John Burling Lawrence,
Mrs. Samuel Lawrence,
Prof. Frederic S. Lee,
Mrs. Frederic S. Lee,
Marshall C. Lefferts,
Wm. H. Lefferts,
James M. Lehmaier,
Arthur L. Lesher,
Dr. A. Monae Lesser,
Wm. H. Leupp,
Emanuel Levy,
Adolph Lewisohn,
Miss Alice Lewisohn,
Julius A. Lewisohn,
Philip Lewisohn,
Paul Lichtenstein,
Lowell Lincoln,
Frederick J. Lisman,
Wm. S. Livingston,
Wm. C. Lobenstine,
Frank J. Logan,
Mrs. Geo. de Forest Lord,
Lord & Burnham Co.,
P. Lorillard, Jr.,
Ethelbert I. Low,
Miss Carlotta R. Lowell,
August Lueder,
Walther Luttgen,
Clarence H. Mackay,
Kenneth K. Mackenzie,
Malcolm MacMartin,
George H. Macy,
V. Everit Macy,
F. Robert Mager,
J. H. Maghee,
Pierre Mali,
Chas. Mallory,
J. A. Manda,
Miss Delia W. Marble,
John Markle,
Dr. J. W. Markoe,
Mrs. Henry Marquand,
Prof. W. C. Marquette,
C. P. Marsh,
Edwin S. Marston,
George Massey,
William J. Matheson,
Francis Taylor Maxwell,
Robert Maxwell,
David Mayer,
Harry Mayer,
Effingham Maynard,
Dr. D. H. McAlpin,
Geo. L. McAlpin,
Rev. Thomas J. McCluskey,
Henry P. McKenney,
John A. McKim,
James McLean,
Edward F. McManus,
B. Frank Mebane,
Herman W. Merkel,
Manton B. Metcalfe,
Herman A. Metz,
Edwin O. Meyer,

Eugene Meyer, Jr.,
George A. Meyer,
Harry J. Meyer,
John G. Milburn,
Geo. M. Miller,
S. M. Milliken,
Mrs. John Murray Mitchell,
Alphonse Montant,
Clement Moore,
Mrs. Clement C. Moore,
J. C. Moore,
Miss Anne Morgan,
Miss C. L. Morgan,
E. D. Morgan,
Mrs. J. P. Morgan,
Wm. Fellows Morgan,
W. Forbes Morgan, Jr.,
Mrs. Cora Morris,
Mrs. Dave Hennen Morris,
Henry Lewis Morris,
Dr. Lewis R. Morris,
Richard Mortimer,
Henry C. Mott,
Frank J. Muhlfeld,
Carl Muller,
John P. Munn,
Frank A. Munsey,
William S. Myers,
A. G. Nesbit,
Mrs. Russell H. Nevins,
Miss Catherine A. Newbold,
Miss Edith Newbold,
Frederic R. Newbold,
Mrs. William G. Nichols,
Wm. Nilsson,
George Notman,
Adolph S. Ochs,
John Offerman,
P. M. Ohmeis,
E. E. Olcott,
Elam Ward Olney,
Robert Olyphant,
R. M. Olyphant,
Mrs. Emerson Opdycke,
Wm. S. Opdyke,
Mrs. Wm. Openhym,
William C. Orr,
Mrs. William Church Osborn,
Prof. Henry F. Osborne,
Jos. Osler,
Fred'k Page Co.,
Augustus G. Paine,
Henry Parish, Jr.,
Junius Parker,
Winthrop Parker,
James C. Parrish,
Chas. W. Parsons,
Mrs. Edwin Parsons,
John E. Parsons,
Mrs. Sarah J. Parsons,
R. W. Paterson,
W. A. Paton,
O. H. Payne,
Mrs. Frederick Pearson,
Edward S. Pegram,
Mrs. Sarah G. T. Pell,
Edmund Penfold,
George E. Perkins,
Samuel T. Peters,
W. R. Peters,
Chas. Pfizer, Jr.,
Mrs. von R. Phelps,
Mrs. William Walter Phelps,
Henry Phipps,
Lloyd Phoenix,
Phillips Phoenix,
Carl Pickhardt,
Gottfried Piel,
Michael Piel,
Henry Clay Pierce,

Winslow S. Pierce,
Mrs. R. Stuyvesant Pierrepont,
J. Fred Pierson,
Mrs. Frank H. Platt,
Albert Plaut,
Gilbert M. Plympton,
Chas. Lane Poor,
Alexander J. Porter,
Abram S. Post,
Miss Blanche Potter,
Frederick Potter,
John T. Pratt,
Miss Cornelia Prime,
Chas. Pryer,
Mrs. Kate Davis Pulitzer,
J. Harsen Purdy,
H. St. Clair Putnam,
Dr. L. Putzel,
Percy R. Pyne,
Charles F. Quincy,
Dr. Edward Quintard,
Charles Raht,
Edmund D. Randolph,
G. B. Raymond,
Geo. R. Read,
Wm. A. Read,
Miss Emily Redmond,
Geraldyn Redmond,
John Reid,
Geo. N. Reinhardt,
Chas. Remsen,
Miss Serena Rhinelander
Miss Elvine Richard,
Eben Richards,
Wm. J. Riker,
George L. Rives,
Dr. Wm. C. Rives,
Geo. I. Roberts,
Miss Mary M. Roberts,
Miss Jennette Robertson,
Andrew J. Robinson,
William G. Rockefeller,
Alfred Roelker,
Edward L. Rogers,
Miss Harriette Rogers,
A. J. Rolle,
W. Emlen Roosevelt,
Mrs. W. Emlen Roosevelt,
Hon. Elihu Root,
Carman R. Runyon,
Jacob Ruppert,
Mrs. A. D. Russell,
John Barry Ryan,
Arthur Ryle,
Harry Sachs,
Paul J. Sachs,
Clarence Sackett,
Miss Lillian Bell Sage,
Mrs. Russell Sage,
Daniel C. Sands,
Miss G. W. Sargent,
Herbert L. Satterlee,
Mrs. Herbert L. Satterlee,
Carl Schefer,
Mrs. H. M. Schieffelin,
Dr. Wm. J. Schieffelin,
Rudolph E. Schirmer,
Miss Jane E. Schmelzel,
D. Schnakenberg,
Henrich Schniewind, Jr.,
C. M. Schwab,
Gustav Schwab, Jr.,
Robert J. F. Schwarzenbach,
Walter Scott,
Miss Grace Scoville,
Robert Scoville,
Edward M. Scudder,
Alonzo B. See,
Charles E. Seitz,
Prof. Edwin R. A. Seligman,

Jefferson Seligman,
E. W. Sells,
Mrs. Charles H. Senff,
Alfred Seton,
George R. Sheldon,
Wm. Shillaber,
John W. Simpson,
Charles A. Singer,
Dr. Frank D. Skeel,
Francis Louis Slade,
Benson B. Sloan,
Samuel Sloan,
Thomas Smidt,
Daniel Smiley,
Chas. F. Smillie,
Dr. A. Alexander Smith,
Miss Fanny A. Smith,
Frank Morse Smith,
F. M. Smith,
Pierre J. Smith,
R. A. C. Smith,
E. G. Snow,
E. G. Soltmann,
Mrs. Charlotte Sorchan,
Mrs. Edward W. Sparrow,
Mrs. Florence Colgate Speranza,
W. M. Sperry,
Miss Anna Riker Spring,
J. R. Stanton,
James H. Stebbins,
James R. Steers,
Chas. H. Steinway,
Fred. T. Steinway,
Wm. R. Steinway,
Olin J. Stephens,
Benjamin Stern,
Sereno Stetson,
Alexander H. Stevens,
Frederic W. Stevens,
Dr. Geo. T. Stevens,
Mrs. John Wood Stewart,
Lispenard Stewart,
Wm. R. Stewart,
Miss Clara F. Stillman,
Dr. D. M. Stimson,
James Stokes,
H. Grant Straus,
Albert Strauss,
Chas. Strauss,
Frederick Strauss,
Samuel Strauss,
Mrs. Gustav Stromberg,
Mrs. Adeline Torrey Strong,
Benj. Strong, Jr.,
John R. Strong,
Joseph Stroock,
F. K. Sturgis,
Mrs. F. K. Sturgis,
Mrs. James Sullivan,
Miss Mary Taber,
Henry W. Taft,
Edward N. Tailer,
James Talcott,
Leon Tanenbaum,
C. A. Tatum,
Henry R. Taylor,
W. A. Taylor,
C. H. Tenney,
H. L. Terrell,
Thomas Thacher,
Miss M. J. Thayer,
Mrs. Emery Jordan Thomas,
Seth E. Thomas, Jr.,
L. S. Thompson,
William B. Thompson,
Dr. W. Gilman Thompson,
Jonathan Thorne,
Samuel Thorne, Jr.,
W. V. S. Thorne,
Myles Tierney,

Louis C. Tiffany,
Henry N. Tifft,
H. M. Tilford,
James Timpson,
J. Kennedy Tod,
C. D. Tows,
P. S. Trainor,
A. F. Troescher,
Frederick K. Trowbridge,
Dr. Alfred Tuckerman,
Paul Tuckerman,
Geo. E. Turnure,
Benjamin Tuska,
Mrs. Mary A. Tuttle,
E. S. Twining,
Mrs. Eliza L. D. Tysen,
Oswald W. Uhl,
Theodore N. Vail,
Mrs. Adelaide S. Van Brunt,
Alfred G. Vanderbilt,
D. B. Van Emburgh,
Barend Van Gerbig,
E. H. Van Ingen,
Edgar B. Van Winkle,
Hon. Robert A. Van Wyck,
Mrs. James M. Varnum,
Richard C. Veit,
Thos. F. Vietor,
Frank Vincent,
Wm. I. Walter,
Artemus Ward,
Chas. Willis Ward,
Mrs. John I. Waterbury,
Mrs. John J. Watson, Jr.,
Thomas L. Watt,
Mrs. E. H. Weatherbee,
F. Egerton Webb,
J. G. Webb,
Mrs. W. Seward Webb,
Miss Alice D. Weekes,
Chas. Wehrhane,
Charles H. Weigle,
Mrs. C. Gouveneur Weir,
Mrs. Samuel W. Weiss,
Mrs. John Wells,
Mrs. Robert E. Westcott,
Geo. Westinghouse,
Mrs. Alice T. Wheelock,
Dr. Wm. E. Wheelock,
Miss Caroline White,
Horace White,
Clarence Whitman,
Miss Margaret S. Whitney,
Edward A. Wickes,
D. O. Wickham,
Elmore A. Willets,
Mrs. I. T. Williams,
Mrs. Percy H. Williams,
Richard H. Williams,
W. P. Willis,
Charles T. Wills,
Frank D. Wilsey,
Prof. Edmund B. Wilson,
George T. Wilson,
Mrs. H. S. Wilson,
Miss Margaret B. Wilson,
Bronson Winthrop,
Egerton Winthrop,
Grenville L. Winthrop,
Mrs. Robt. Winthrop,
Mrs. Frank S. Witherbee,
Dr. R. A. Witthaus,
Ernst G. W. Woerz,
Emil Wolff,
Lewis S. Wolff,
William E. Wolff,
Mrs. Cynthia A. Wood,
Henry R. Wood,
Prof. R. S. Woodward,
Mrs. William Woodward, Sr.

W. H. Woolverton,
P. B. Worrall,
Miss Julia Wray,
Mrs. J. Hood Wright,
A. Wurzburger,
Mrs. A. Murray Young,
Edw. L. Young,
Andrew C. Zabriskie,
Mrs. Anna M. von Zedlitz,
Mrs. John E. Zimmermann,
August Zinsser,
Charles Zoller,
O. F. Zollikoffer.

Members of the Women's Auxiliary

Mrs. Robert Bacon,
Mrs. Thomas H. Barber,
Miss Elizabeth Billings,
Miss Eleanor Blodgett,
Mrs. James L. Breese,
Mrs. Delancey Kane,
Mrs. A. A. Low,
Mrs. V. Everit Macy,
Mrs. Henry Marquand,
Mrs. George W. Perkins,
Miss Harriette Rogers,
Mrs. James Roosevelt,
Mrs. Archibald D. Russell,
Mrs. Benson B. Sloan,
Mrs. Henry O. Taylor.

REPORT OF THE TREASURER

NEW YORK, January 7, 1915.

TO THE BOARD OF MANAGERS OF THE NEW YORK BOTANICAL GARDEN.

Gentlemen: Herewith I submit a statement of my receipts and disbursements during the year 1914, and a balance sheet from my ledger as of December 31, 1914.

Respectfully yours,

JAMES A. SCRYMSER,

Treasurer.

RECEIPTS AND DISBURSEMENTS

Receipts

Balance as per last Annual Report.		$ 66,645.76
Contributions of the City toward Development and Maintenance.	$ 99,571.46	
Subscriptions to Endowment Fund for Science and Education.	8,610.00	
Legacy, Addison Brown, 200 shares U. S. Steel Prfd. (Jan. 26, 1914). . .	21,850.00	
Charles Budd Robinson Memorial Fund Contributions	534.30	
Investment, Addison Brown Legacy, Proceeds of sale of 200 shares U. S. Steel Prfd. November 30, 1914. . .	20,771.00	
Income from General Investments:		
Credited General Income Account:		
5% on $50,000 Southern Ry. Co. 1st Consolidated Mortgage Bonds.	$ 2,500.00	
4½% on $50,000 Ches. & Ohio R. R. Co. General Mortgage Bonds.	2,250.00	
4% on $50,000 Erie R. R. Co. Prior Lien Bonds. .	2,000.00	
4% on $59,000 Erie R. R. Co. Penn.-Coll. Trust Bonds.	2,360.00	

4% on $50,000 Reading R. R. Co. Jersey Central Coll. Trust Bonds . . .	2,000.00	
4% on $24,000 Northern Pacific R. R. St. P. & D. Div. Bonds. . . .	960.00	
4% on $30,000 Northern Pacific R. R. Gt. Nor.- C. B. & Q. Coll. Trust Bonds.	1,200.00	
4% on $10,000 New York City 4% Stock of 1959.	400.00	
4½% on $53,000 Grand Trunk Equipment Notes.	2,385.00	
5% on $10,000 Louisville & Nashville Equipments.	500:00	
4½% on $10,000 N. Y. Central Lines Equipment.	450.00	
4% on $11,000 Milwaukee, Sparta & Western R. R. Bonds.	440.00	
	$17,445.00	
Less interest on $50,000 N. Y. City Notes due Sept. 1, 1917 (6%). . . .	241.67	$ 17,203.33
Income from Addison Brown Fund, Investment, Dividends on 200 shares U. S. Steel Prfd.		1,400.00
Interest at 3% on balances with J. P. Morgan & Co.		1,759.41
Annual Dues.		7,960.00
Life Membership Fees.		250.00
Fellowship Members' Fees.		700.00
Sustaining Members' Fees.		350.00
Subscriptions to "North American Flora," sales of Publications, etc., credited Income of David Lydig Fund		2,317.82

Contributions, etc., to Plant Fund.....	1,381.20	
Contributions, etc., to Students Research Fund.....	150.00	
Contributions, etc., to Special Fund for Books.....	3,825.00	
Contributions, etc., to Museum and Herbarium Fund.....	10.00	
Refund, credited to Income of Stokes Fund.....	2.45	
Sundry refunds, Sales of Merchandise and Materials.....	80.00	
Total Receipts.....	$188,725.97	$188,725.97

Disbursements

Investment of Science and Education Fund, $50,000 New York City 6% Notes, due Sept. 1, 1917.....	$ 51,281.25	
Investment of John Innes Kane Fund, $10,000 New York City 6% Notes, due Sept. 1, 1917.....	10,256.25	
Investment Addison Brown Legacy, 200 shares United States Steel Prfd. (taken at market rate when transferred).....	21,850.00	
Income from Investment of John Innes Kane Fund. Interest on N. Y. City Notes.....	48.33	
Income from Investment Addison Brown Fund, March 1914 dividend on 200 shares U. S. Steel paid to Mrs. Addison Brown as per agreement....	350.00	
Investment Addison Brown Legacy, Expenses of transfer in sale of 200 shares of U. S. Steel.....	4.50	
Expenses paid through Director-in-Chief:		
Account of City Appropriations.....	99,571.46	
On General Account for Vouchers paid.....	22,720.80	
Special Book Fund for Books.....	3,066.50	

Plant Fund for Purchase of Plants . .	1,948.00	
Income of David Lydig Fund for Publications	4,285.16	
Income of D. O. Mills Fund, for Sundries	2,652.32	
Income of Stokes Fund for Printing . .	110.35	
Income of Science and Education Fund	2,225.05	
Income of John Innes Kane Fund	288.20	
Income of Henry Iden Fund	287.50	
Income of William R. Sands Fund .	352.00	
Total Disbursements	$221,297.67	
Balance, Cash in hands of Treasurer (on deposit with J. P. Morgan & Co.)	34,074.06	
	$255,371.73	$255,371.73

Ledger Balances, December 31, 1914

Credit

Permanent Funds

Endowment Fund	$304,510.00
Endowment Fund for Science and Education	75,455.00
David Lydig Fund, Bequest of Charles P. Daly	34,149.86
Legacy of Wm. R. Sands	10,000.00
Darius Ogden Mills Fund	50,000.00
Henry Iden Legacy	10,000.00
Addison Brown Legacy	21,850.00
John Innes Kane Fund	10,000.00
Stokes Fund	3,000.00
Charles Budd Robinson Memorial Fund	534.30
Students' Research Fund	3,467.00
	$522,966.16

Temporary Funds

Income of Stokes Fund	$ 70.83	
Income from Addison Brown Fund	1,050.00	
Life Membership Dues	250.00	
Exploration Fund	24.05	
Charles Finney Cox Memorial Fund	6.90	
Income Students' Research Fund	153.21	
Special Fund for Books	817.00	
Plant Fund	407.78	$525,745.93

Debit

General Investments

$50,000 Ches. & Ohio Gen'l Mtge. Bonds		
50,000 So. Ry. Co. 1st Cons. Mtge. Bonds		
50,000 Erie R. R. Co. Prior Lien Bonds		
59,000 Erie R. R. Co. Penn.-Coll. Tr. Bonds		
50,000 Reading R. R. Co. J. C. Coll. Tr. Bonds		$312,424.18
24,000 Nor. Pac. R. R.-St. P. & D. Div. Bonds		
30,000 Nor. Pac. Gt. Nor.-C. B. & Q. Coll. Tr. Bonds		
10,000 N. Y. City, 4% Stock, 1959		
Investment, D. O. Mills Fund, $53,000 Grand Trunk Railway Equipment Notes		50,015.63
Investment, Science and Education Fund,		
$10,000 N. Y. Central Lines Equipment	$ 9,510.48	
10,000 Louisville & Nashville Equipment	10,000.00	
50,000 N. Y. City Notes (6%) due Sept. 1, 1917	51,281.25	70,791.73

Investment, Henry Iden Fund,		
$11,000 Milwaukee,		
Sparta & N. W. R. R.		
Bonds.....		10,120.00
Investment, Addison Brown		
Legacy,		
200 shares U. S. Steel		
Prfd. at market rate		
Jan. 26, 1914.....	$21,850.00	
200 shares U. S. Steel		
Prfd. sold Nov. 30,		
1914	20,766.50	
Balance.....	$ 1,083.50	$ 1,083.50
Investment, John Innes Kane Fund,		
$10,000 N. Y. City Notes (6%) due		
Sept. 1, 1917.....		10,256.25
		$454,691.29
Income from John Innes Kane Fund,		
Interest paid Sept. 30, on N. Y.		
City Notes.....		48.33
Income of David Lydig Fund, Balance		
borrowed from Permanent Funds...		1,625.98
Income of D. O. Mills Fund.....		903.72
Income of John Innes Kane Fund.....		56.54
Director-in-Chief, Working Fund....		25,000.00
Museum and Herbarium Fund.....		26.92
General Income Account, Balance bor-		
rowed from Permanent Funds.....		9,319.09
Cash in hands of Treasurer (on deposit		
with J. P. Morgan & Co.).....		34,074.06
	$525,745.93	$525,745.93

REPORT OF THE SPECIAL AUDITOR

Treasurer's Account for the Year 1914

Room 3111, Grand Central Terminal,
New York, February 19, 1915

Mr. Edward D. Adams,
Chairman, Finance Committee, New York Botanical Garden,
71 Broadway, New York, N. Y.

Dear Sir:

This is to certify that I have, by direction of the Board of Managers, examined the books and accounts of the Treasurer of the New York Botanical Garden, for the year nineteen hundred and fourteen (1914), together with their proper vouchers, and that I find the balance sheet and the Treasurer's statement of receipts and disbursements attached hereto to be correct.

Respectfully submitted,

A. W. Stone,
Special Auditor.

Director-in-Chief's Account for the Year 1914

Room 3111, Grand Central Terminal,
New York, February 19, 1915

Mr. Edward D. Adams,
Chairman, Finance Committee, New York Botanical Garden,
71 Broadway, New York, N. Y.

Dear Sir:

This is to certify that I have examined and audited the financial books and accounts of the Director-in-Chief of the New York Botanical Garden for the year nineteen hundred and fourteen (1914), and that I find the same to be correct, and the cash balance to be as stated in the current cash book.

In accordance with recent practice, I have not included in this auditing the examination of the vouchers for City maintenance or construction work paid for by the City, as such vouchers have been found proper and in order by the City authorities, and it was decided in 1904 by the Chairman of the Finance Committee that a further examination of them was unnecessary. By like authority I have omitted also a detailed examination of the annual membership dues account. These dues are received by the Director-in-Chief and forwarded by him to the Treasurer, the former keeping a detailed record of the same.

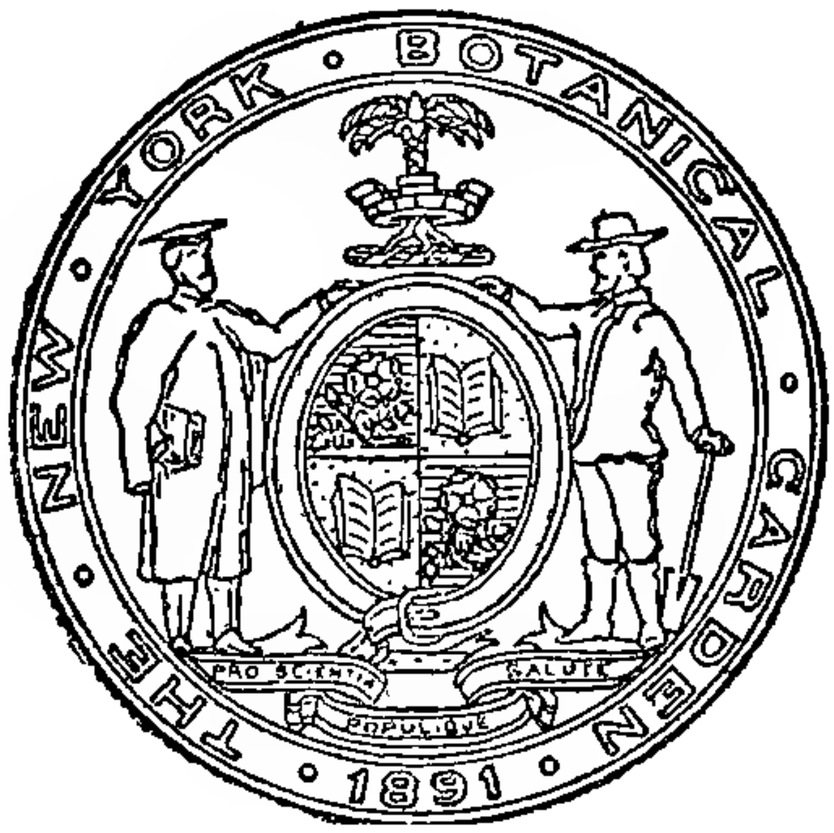
Respectfully submitted,
A. W. Stone,
Special Auditor.

VOL. 9 NO. 33

BULLETIN

OF

THE NEW YORK BOTANICAL GARDEN



[ISSUED MARCH 20, 1916]

OFFICERS 1916

PRESIDENT—W. GILMAN THOMPSON
VICE-PRESIDENTS { ANDREW CARNEGIE
FRANCIS LYNDE STETSON
TREASURER—JAMES A. SCRYMSER
SECRETARY—N. L. BRITTON

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1. ELECTED MANAGERS

Term expires January, 1917

EDWARD D. ADAMS
ROBERT W. DE FOREST
J. P. MORGAN
JAMES A. SCRYMSER
HENRY W. DE FOREST
DANIEL GUGGENHEIM

Term expires January, 1918

N. L. BRITTON
ANDREW CARNEGIE
W. J. MATHESON
LEWIS RUTHERFORD MORRIS
W. GILMAN THOMPSON
FREDERIC R. NEWBOLD

Term expires January, 1919

GEORGE McANENY
GEORGE W. PERKINS
FRANCIS LYNDE STETSON
MYLES TIERNEY
LOUIS C. TIFFANY

2. EX-OFFICIO MANAGERS

THE MAYOR OF THE CITY OF NEW YORK
HON. JOHN PURROY MITCHEL

THE PRESIDENT OF THE DEPARTMENT OF PUBLIC PARKS
HON. GEORGE CABOT WARD

3. SCIENTIFIC DIRECTORS

PROF. H. H. RUSBY, *Chairman*
EUGENE P. BICKNELL
DR. NICHOLAS MURRAY BUTLER
WILLIAM G. WILLCOX
PROF. WILLIAM J. GIES
PROF. R. A. HARPER
PROF. JAMES F. KEMP
PROF. FREDERIC S. LEE

GARDEN STAFF

DR. N. L. BRITTON, *Director-in-Chief* (Development, Administration)
DR. W. A. MURRILL, *Assistant Director* (Administration)
DR. JOHN K. SMALL, *Head Curator of the Museums* (Flowering Plants)
DR. P. A. RYDBERG, *Curator* (Flowering Plants)
DR. MARSHALL A. HOWE, *Curator* (Flowerless Plants)
DR. FRED J. SEAVER, *Curator* (Flowerless Plants)
ROBERT S. WILLIAMS, *Administrative Assistant*
PERCY WILSON, *Associate Curator*
DR. FRANCIS W. PENNELL, *Associate Curator*
GEORGE V. NASH, *Head Gardener*
DR. A. B. STOUT, *Director of the Laboratories*
DR. JOHN HENDLEY BARNHART, *Bibliographer*
SARAH H. HARLOW, *Librarian*
DR. H. H. RUSBY, *Honorary Curator of the Economic Collections*
ELIZABETH G. BRITTON, *Honorary Curator of Mosses*
DR. ARTHUR HOLLICK, *Honorary Curator of Fossil Plants*
DR. WILLIAM J. GIES, *Consulting Chemist*
COL. F. A. SCHILLING, *Museum Custodian*
JOHN R. BRINLEY, *Landscape Engineer*
WALTER S. GROESBECK, *Clerk and Accountant*
ARTHUR J. CORBETT, *Superintendent of Buildings and Grounds*

BULLETIN
OF
The New York Botanical Garden

Vol. 9 No. 33

REPORT OF THE SECRETARY AND DIRECTOR-IN-CHIEF FOR THE YEAR 1915

(*Accepted and ordered printed, January 10, 1916*)

To the Board of Managers of the New York Botanical Garden.

Gentlemen: I have the honor to submit herewith my report as Secretary and Director-in-Chief for the year ending January 10, 1916.

The most noteworthy event in the history of the institution during the year was the grant by the Board of Estimate and Apportionment, on January 29, 1915, of the use of over 140 acres of Bronx Park, additional to the original reservation of 250 acres set aside and appropriated by the Commissioners of Public Parks in 1895, and signalizing the Twentieth Anniversary of the first allotment of ground for the purposes of the Garden. This action by the city increases the area of the New York Botanical Garden to nearly 400 acres, making it the largest institution of its kind in the temperate zones, and provides unequaled opportunity for further development. With the use of this land came the use of the large stone mansion built by the Lorillard family in 1856, an edifice containing 45 rooms, and available for many useful purposes. The Garden reservation now comprises all of Bronx Park north of Pelham Avenue except three small areas reserved for the use of the Park Department, occupied by its greenhouses, shop, stable, and music-stand.

By means of a fund aggregating $10,357, generously subscribed by 148 members and friends, and designated the "Garden Extension and Commemoration Fund," considerable preliminary work in the development of this additional land and in the renovation of the mansion has been accomplished, including the cutting out of dead trees and of stumps, the filling and draining of marshy areas, the partial construction of an unfinished driveway and the partial construction of paths, the breaking of loose stone, and the commencement of planting at several points. A complete survey and map of the additional tract has been prepared by the Landscape Engineer, who has also submitted a plan for roads and paths, which was approved at your meeting of November 18, 1915. The mansion was found to be greatly in need of repairs, many of which have been accomplished, including exterior and interior painting, new leaders and gutters, the reconstruction of porches, the furnishing and decoration of board rooms, and the installation of a steam heating plant and of shops in the basement. The Twentieth Anniversary of the first appropriation of land was commemorated during the week commenced September 6 by a largely attended meeting of botanists from all over the eastern United States.*

New construction and new planting have, for the most part, been confined to the additional land, but, in the early part of the year, some work was done in building paths and in grading near conservatory range 2, and a new rhododendron group was planted at conservatory range 1 by the aid of the income of the John Innes Kane Fund. The development of the original reservation has not, by any means, been completed, construction work being yet required near the museum building, about conservatory range 2, in an area of about 3 acres at the northern corner of the grounds, and additional paths are needed in other areas. An additional wing to the museum building and additional greenhouses at conservatory range 2 are much

* See Jour. N. Y. Bot. Gard. 16: 203–219.

needed for satisfactory display and storage of the collections.

The number of kinds of plants now represented in outdoor plantations and under glass aggregates very nearly 14,000 species and varieties. Over 36,000 specimens were added to the museum and herbarium collections, these now aggregating considerably more than 1,500,000 specimens. The library was increased by over 900 volumes, the number of bound volumes being now 27,224.

Attractive opportunities for investigation are furnished by these vast collections. During the New York meeting of the National Academy of Sciences in November, the Garden was visited by members of that organization, and the point was made that great additions to knowledge could be contributed by scientific study of the collections now brought together after twenty years' effort, the spacious grounds and capacious buildings providing ample facilities, financial provision only for salaries and expenses of a staff of trained investigators, assistants, and gardeners being required to place the institution on the basis of a botanical and horticultural university.

Public lectures were delivered to appreciative audiences on Saturday afternoons from April 3 to November 20. Docentry has been continued with schools and parties of adults, and is one of the most efficient methods we have of disseminating information about the institution and its collections. There is a constant increase in the information about plants and plant products requested by correspondents. Library and laboratory work was conducted with 16 registered advanced students from colleges and universities. Exploration was accomplished in Porto Rico, in eastern South America, in southern Florida, and in the Rocky Mountain region.

Publications during the year include Volume 16 of the *Journal*, Volume 7 of *Mycologia*, 3 parts of *North American Flora*, 1 number of *Bulletin*, 1 volume of *Memoirs*, and 11 numbers of *Contributions*. Most of these publications have

been aided by the income of the David Lydig Fund bequeathed by Charles P. Daly.

The natural features of the reservation have suffered no deterioration. Guarding of the grounds was extended over the additional land during the spring, and good results of this extension are already apparent. The largely increased area has brought with it, among other responsibilities, a greatly increased number of visitors, and, for the certain protection of many valuable natural features, it is essential that a path system be built through it as soon as possible. The approved plan of development contemplates the construction of about 4 miles of path in the additional land, and it is earnestly desired that at least 1 mile be completed during 1916. Guard-rails will be needed along portions of the new paths, and additional guard-rails are stil needed along paths of the system already completed. The efficient enforcement by the police of city ordinances forbidding depredations and littering of public grounds, following a special order of His Honor the Mayor, contributed greatly to the care and protection of the Garden reservation.

Permanent funds of the institution have been increased during the year by the payment of 55 per cent. of the bequest of $25,000 by Maria DeWitt Jesup, or $13,750, by $1,000 bequeathed by Jacob Langeloth, by $2,000 Life Fellowship fees from Messrs. Murry and S. R. Guggenheim, by one Life Membership fee of $250, and by additions to the Students Research Fund amounting to $154, aggregating $17,154, the total endowment now aggregating a little over $540,000. A detailed acount of permanent funds and endowment, together with statements relative to additional funds desired, was published and distributed during the year,* suggesting an increase of the total endowment to $2,000,000 or more.

Surveys and Plans

The Park Department kindly permitted us to use a survey made several years ago of the land added to the

* See Jour. N. Y. Bot. Gard. 16: 123–130.

Garden, and this avoided the necessity of instrumental work; the map accompanying this survey was drawn, however, to the scale of 60 feet to the inch, whereas all our other maps have been drawn to the scale of 50 feet to an inch. Mr.Brinley enlarged this survey map, and the record, on three folio sheets, has been added to survey maps made in 1895 and 1896. We thus have complete records of the original topography of the entire area.

Based upon the survey thus obtained and careful studies in the field, Mr. Brinley prepared the general plan of development of the additional land, which was approved at your meeting of November 18, 1915. The preparation of plans for a rose garden was referred to Mrs. Beatrix Farrand in cooperation with Mr. Brinley at the meeting of June 17. Progress has been made in this study and preliminary plans were submitted at the meeting of November 18, and referred to a committee for further consideration and report.

Connection with the Bronx River Parkway

The plans of the Bronx Parkway Commission for the development of the reservation extending from the northern end of the Garden north to Kensico are now being elaborated, and conferences have been held with the engineers and other officials of that Commission relative to the connection of Garden driveways and paths. A harmonious result has been arrived at, and a plan showing proposed connections will be submitted to us by the Bronx Parkway Commission in the near future. It is probable that a portion of our border screen at the northern end of the grounds had better be eliminated, for there seems no reason for a sharply defined boundary being maintained. It will be recalled that in 1911, at the request of the President of the Borough of The Bronx, we tentatively approved a plan submitted by him for the construction of a boundary street along the northern side of the Garden on a high level viaduct, the location of this proposed street being partly

on the Garden reservation and now partly on land of the Bronx Parkway Commission, inasmuch as it has never been formally condemned for street purposes.

The creation of the Bronx River Parkway has now made the construction of this street undesirable, and the tentative plans of the Commission do not include it.

Grading and Drainage

The rough, steep river banks on the additional land at the Linnaean bridge were graded and regulated early in the spring. An old quarry on the hill near the southwestern corner of the grounds, an unsightly and dangerous feature, has been nearly filled by a contractor without cost to the Garden, and the original contour of the hill thus essentially restored. Some filling has also been obtained without cost from contractors for the bank against the railroad at the extreme northern corner of the Garden. Following a plan approved by you June 17, 1915, and previously approved by the Commissioner of Parks of the Borough of The Bronx, the grading necessary to establish the new driveway south of the mansion and crossing the north end of the long lake has been about one half completed, and this work is still in progress. At the extreme southwestern corner of the grounds, in establishing the iris garden and a portion of the path system, much grading and regulating were accomplished. At conservatory range 2, unfinished banks and lawns were regulated and graded, and minor work of this character has been done at other points, including some preliminary grading at the rose garden site.

At power house 2, additional work was accomplished early in the year in the construction of the deep drain designed to relieve the present trouble caused by springs under the steam-pipe tunnel, a road culvert north of the western end of the Linnaean bridge was connected with the river by a 12-inch drain, a 6-inch drain-pipe was laid through the entire length of the valley planned for the rose

garden, replacing an open stone ditch and draining other areas which were prolific mosquito breeders.

Roads and Paths

The Telford foundation for a small portion of the driveway under construction south of the mansion was laid with stone obtained during grading work, and there is enough loose stone in the area near the eastern end of this unfinished drive to pave a considerable part of it. The completion of this road is much to be desired and it will finish the driveway system of the entire reservation as at present planned. Its completion will permit the elimination of the narrow and very dangerous road which approaches the mansion from the north, which may then revert to a path as originally planned; there have been several accidents on this narrow road and it should be done away with as soon as possible. It is planned, however, to retain the driveway approach to the mansion from the south, but this should be widened as a measure of precaution and to accommodate the continually increasing travel, as contemplated on the approved general plan.

In order, as soon as possible, to restrict pedestrians to paths, work on path construction was commenced during the season on the part of the additional land lying west of the Bronx River, and a path has been partially completed extending north from the Linnaean bridge along the west side of the river for a distance of about 900 feet, then diverging from the river and entering the hemlock grove about 600 feet further northwest, designed to reach the gorge bridge about 700 feet further north. The completion of this path, which it is hoped to accomplish during 1916, will provide a continuous walk the entire length of the reservation from Pelham Avenue to the southern end of the Bronx Parkway, near and along the river. Stone for paving this path may be assembled during the winter. In building the iris garden at the southwestern corner of the additional land, paths about 500 feet long were nearly

completed; it is hoped to connect the iris garden with the path running north to the herbaceous garden during next season. About 400 feet of path running northwest from conservatory range 2 was partially constructed, and some work was done on paths on the eastern side of this conservatory range. The total length of paths partially constructed during the season is nearly half a mile. With trap-rock screenings furnished by the Park Department, the pinetum path, built last year, was permanently surfaced, and repairs to the surfaces of paths at many points were made.

The maintenance of driveways has been accomplished by the Park Department as required by the charter of the Garden, and the surfaces have now been brought into good condition, except the road east of the Bronx River extending north from the long bridge to the Bronx River Parkway, and the road running south from the herbaceous garden to the Linnaean bridge; the Park Department proposes to put these roads in good order first thing in the spring, and material for this purpose has been assembled. The maintenance of paths, although referred to the Park Department by the Garden's charter, has been accomplished by us.

All the bridges in the road and path system are in good order, and have not required any repairing during the year.

Electric Lighting of the Driveways

During the season, the Department of Water Supply, Gas and Electricity submitted a series of plans for the electric lighting of the driveways throughout the entire reservation, to take the place of the naphtha lamps previously in use. These plans were carefully studied in consultation with engineers of this city department and locations for cables along the edges of the roads were determined, especial care being taken to avoid cutting the roots of any trees. I required, before approving the plans, that no tree root over half an inch in diameter should

be cut but a cable passed under it. I found the engineers of the department quite as solicitous as I was that trees should not be endangered, and the work was accomplished with the greatest care and no damage to trees is anticipated; the companies contracting for the work performed it expeditiously and neatly, taking the sod from all trench excavations necessary and replacing it so that within a few days after the cables were laid it was difficult to detect their position; they have been very accurately mapped, however, and it is hoped that subsequent operations may not disturb them at any point. The entire system of driveways west of the Bronx River was thus supplied with electric lights and the current turned on in December. The work along the main roads east of the river is not yet quite completed. The posts used for electric lights are neat in design and were approved by the Art Commission.

Along the road leading north from Pelham Avenue past the mansion, the northern part of which will revert to a path and the southern part will require widening, the electric installation is temporarily on poles, but the department will place these wires under ground after the roadway construction in progress in that part of the grounds is completed.

Water Supply

There has been no extension of the water supply system during the year, and only ordinary repairs to it have been required.

The additional land has a water supply system on both sides of the river, and this, by the aid of recollection of employees of the Park Department, has been located on our general plan, probably not with very great accuracy, although the position of parts of it has been determined by excavations. The land east of the Bronx River is traversed by a 4-inch water pipe which extends from a main on the Pelham Parkway north through the rose garden site, past the Park Department's stables and greenhouses, to the mansion, but it does not supply the mansion with

water, the pressure of this system being too low for service there. The mansion is supplied by a 2-inch pipe laid a number of years ago from a point on the 36-inch water main near the driveway northeast of conservatory range 1 eastward across the herbaceous garden valley and through the hemlock grove, passing under the Bronx River a little north of the gorge bridge, and branches from this pipe also supply the Park Department's stables, a portion of their greenhouses, and their shop. The pressure in this pipe is sufficient to reach only the second story of the mansion, and that only somewhat intermittently.

There is a 2-inch water pipe which traverses the additional land west of the Bronx River from a point near the southwestern corner of the grounds north to near the southern end of the herbaceous garden.

Buildings

With the exception of the mansion, which came to us with the additional land granted by the city, all buildings are in good order and have required only ordinary repairs. The roof of the museum building, referred to in previous reports as requiring attention, was carefully gone over and most of the leaky places in it repaired, but there are still a few points which are giving trouble. A violent storm and high wind toward the end of December broke in about 40 panes of glass of conservatory range 1, the greatest glass breakage which has occurred in several years.

Repairs to the mansion have included the partial rebuilding of its two porches, new shingles on about one third of its roof, carpentering work on floors, doors, windows, and trimmings, interior and exterior painting, which is still in progress, new sinks and other plumbing work, new gutters, and an entire replacement of leaders. Interior repairs on this building have been restricted to the basement and first and second floors, the third and fourth floors are still in a very dingy and dilapidated condition. The steam heating plant installed extends only to the second

floor, but the furnace selected is capable of extension sufficient to heat the entire structure.

Two small stone buildings, used for public comfort stations, also came to us with the additional land, one situated near the mansion and north of it, the other a greater distance to the south.

No repairs have been necessary to boundary walls and fences, and they are in good condition. The extension of boundary fences around the additional land is much to be desired, and until these structures are obtained no complete protection of this area can be effected.

The plans for the development of the Bronx River Parkway indicate that no boundary barrier will be necessary at the northern end of the grounds.

In the report of the Superintendent of Buildings and Grounds hereto appended, detailed accounts of maintenance and construction will be found.

Natural Features

Except for the uprooting of over 50 large trees during violent storms at the end of the year, there has been no loss in the beauty of the woodlands, and the trees are so numerous that the removal of these fallen ones will not be noticeable. The woodlands have been continually patrolled to guard against fire and vandalism, and no appreciable damage has been done. Over 1,200 dead trees were cut on the additional land early in the year and several hundred stumps were extracted. Some dead trees and stumps still remain and part of them, at least, may be removed this winter. The placing of additional guard-rails along parts of the path system is still necessary.

Plants and Planting

All the plantations heretofore established have been maintained, and additions have been made to the arboretum, pinetum, fruticetum, herbaceous grounds, and the flower gardens. In the spring, a new rhododendron planta-

tion was established on the north side of conservatory range 1, the plants purchased by an appropriation from the income of the John Innes Kane Fund.* Early in the spring, a considerable number of trees were planted near and along the western bank of the Bronx River north of the Linnaean bridge, and the banks at that bridge were planted with several kinds of willows. In the autumn, a commencement was made to extend the deciduous arboretum southward on the additional land by planting several kinds of poplars east of the long lake near the Bronx Boulevard, and ground was prepared and some preliminary planting accomplished near the iris garden at the southwestern corner of the grounds. Many plants were moved from the nurseries, both in the spring and in the autumn, to permanent places in various parts of the grounds.

Substantial additions have been made to the greenhouse collections, the most noteworthy being several hundred cactuses and other plants collected by Dr. J. N. Rose during the year in Brazil and Argentina, in continuation of our cooperation in the cactus investigation with the Carnegie Institution of Washington; a fine collection of Brazilian orchids presented to the Garden by Dr. Y. de Oliveira Botelho, Brazilian Delegate to the Second Pan-American Scientific Congress; and a collection of native ferns of Porto Rico obtained during our expedition to that island in the spring.

A detailed account of the composition of the collections and of gardening work will be found in the report of the Head Gardener hereto appended.

Cultivation of Drug and Dye Plants

At the meeting of the Board of Managers held April 15, 1915, Mr. Edward D. Adams discussed the desirability of disseminating information relative to the production of drugs and dyes, of which the supply had been reduced by war conditions in Europe, and the topic was referred to the

* See Jour. N. Y. Bot. Gard. **16**: 130–132.

Scientific Directors for report. At a meeting of the Managers held June 17, Dr. Rusby, Chairman of the Scientific Directors, submitted a report upon the cultivation of drug and dye plants, which was published in the August issue of Garden *Journal*,* and reprinted for further distribution. There has since been a considerable demand for this pamphlet, notices and reviews of which have appeared in many newspapers, and requests for copies of it are still received. In order to further bring the subject to attention, several members and friends of the Garden have established plantations of drug plants on their estates, and there is no doubt that the subject has attracted wide attention and consideration.

Museums and Herbarium

The museum and herbarium collections have been cared for by the same curatorial staff as during the previous year, Dr. F. W. Pennell taking the position of Associate Curator made vacant by the death of Dr. Charles Budd Robinson the year before. Considerable rearrangement of specimens has been made and additions have been incorporated for the better illustration of many groups. Funds have not been available for the construction of additional cases, which are still much needed, many specimens being held in the storage room. The principal additions made were obtained by our own exploration work and by exchanges with other institutions. A noteworthy gift of specimens of hepaticae by Miss Caroline Coventry Haynes† enriches our collection of these plants. Income from the Maria DeWitt Jesup Fund, available toward the end of the year, made possible the purchase of two important collections.

The report of the Head Curator of the Museums and Herbarium hereto appended gives details of accessions to the collections and of work upon them, and additional data will be found in the reports of the Honorary Curator

* See Jour. N. Y. Bot. Gard. **16**: 155–172.
† See Jour. N. Y. Bot. Gard. **16**: 226.

of the Economic Collections, the Honorary Curator of Mosses, and the Honorary Curator of the Collection of Fossil Plants.

Library

Additions to the library were, for the most part, by gifts and by exchanges of our publications for those of other institutions and associations. Little money was available during the year for purchases. A permanent fund which would make the more rapid growth of the library certain is greatly desired. The collection still lacks many volumes of the older literature of botany and horticulture, and these books are continually becoming more difficult to secure and more expensive. Our present available funds are insufficient to enable us to purchase all current botanical and horticultural literature. The most noteworthy gift of books was made by Mrs. Addison Brown, from the library of the late Judge Addison Brown, containing many valuable volumes.*

Reports of the Librarian and of the Bibliographer hereto appended contain additional information relative to this collection.

Laboratories and Experimental Gardens

Instruction of advanced students and cooperation with investigators from other institutions have been continued during the year, 16 registered students having utilized the facilities of the laboratories and experimental gardens, and having conducted researches over a wide range of subjects. The income of the Henry Iden Fund has been used for the payment of resident research scholarships, and grants in aid of student investigations have been made from the income of the Students Research Fund. The area of land used for experimental gardens at the nurseries has proved sufficient, but an increase in greenhouse space there is desirable, in order to supply additional facilities for plant breeding and for studies in plant pathology.

* See Jour. N. Y. Bot. Gard. **16**: 120–122.

The report of the Director of the Laboratories hereto appended presents a record of the work of students and an outline of investigations conducted.

Public Instruction

Thirty-four public lectures were delivered on Saturday afternoons during the season, all but nine of them delivered by members of the staff. Titles of these lectures are recorded in the appended report of the Assistant Director, which also contains records of publications issued during the year, of meetings held, and of instruction given by employees detailed as docents.

Labeling of the collections has been continued, and it is by means of the labels accompanying plants and specimens that the greatest amount of information is furnished to visitors. Informational labels aggregating 5,498 have been painted for plants in the grounds and greenhouses, the total number of such labels now in place being over 20,000. These labels give an English name and the botanical name of the plant, the country where it is native, and the family to which it belongs. If funds were available for the purpose, this system of information might be much elaborated by putting more on the labels than we are now able to do; this would necessarily increase their size and make them more conspicuous. There are some objections to increasing their prominence in the landscape, however.

Exploration

Botanical work in Porto Rico was continued in the early part of the year through an expedition by the Director-in-Chief and Mrs. Britton, accompanied by Mr. John F. Cowell, Director of the Buffalo Botanical Garden, and by Mr. Stewardson Brown, Curator of Botany at the Philadelphia Academy of Sciences, and also by Professor Wille, Director of the Botanical Garden of Christiania, Norway, accompanied by Mrs. Wille.* Extensive and important

* See Jour. N. Y. Bot. Gard. **16**: 103–112; 132–146.

collections were secured. Porto Rico was also visited in the summer by Dr. Marshall A. Howe, Curator, for the purpose of obtaining additional representation of the marine algae.* All this work was in cooperation with the scientific survey of Porto Rico organized by the New York Academy of Sciences in cooperation with the American Museum of Natural History, the Insular Government of Porto Rico, and other institutions.

In further cooperation with the Carnegie Institution of Washington in the investigation of the cactus family prosecuted for several years, Dr. J. N. Rose visited eastern Brazil and Argentina during the summer and obtained specimens of these plants and of others, which greatly enrich our collections; this work was made possible by an appropriation from the income of the Darius Ogden Mills Fund.

Dr. J. K. Small, Head Curator, has continued investigation of the flora of extreme southern Florida, by the aid of funds liberally contributed by Mr. Charles Deering, and he is at present engaged in field work there.

Dr. F. W. Pennell, Associate Curator, spent two months of the summer in exploration work in the central Rocky Mountains, with special reference to the collection and study of plants of the figwort family. Mr. Percy Wilson, Associate Curator, continued studies of the local flora in Delaware County, New York, during a period of about one month. Both these trips were aided by grants from the income of the Darius Ogden Mills Fund.

Preservation of Native Plants

A further distribution of 30 sets of framed copies of colored illustrations of wild flowers needing protection has been made to schools, and our supply of these frames has now been exhausted. Requests are received for them from time to time and it is proposed to obtain an additional supply. Competition prize essays on wild flowers needing protection were invited from schools in New York City,

* See Jour. N. Y. Bot. Gard. 16: 219–225.

and submitted on Arbor Day, the successful student being awarded one of these frames for his or her school. Mrs. Britton conducted the correspondence connected with this distribution and also visited several schools and made addresses on the subject. It is proposed to utilize the income of the Caroline and Olivia E. Phelps Stokes Fund for the preservation of native plants, which has made this effort possible, for the reproduction of 3 additional wild flowers, which will increase the set to 12 subjects, 8 having been used in frames hitherto distributed and 1 reproduced set held in reserve. Selections of the essays submitted by the school children have been published.* A further record of this work will be found in the report of the Honorary Curator of Mosses hereto appended.

Investigations

Investigational work by members of the staff has been continued during such time as administrative and curatorial duties have permitted, and records of this work will be found in the accompanying reports of the several officers. This work has included taxonomic studies in relation to the preparation of manuscript for *North American Flora* and other publications, which closely interlocks with curatorial work; and investigations in plant breeding, which have been closely associated with the work of students. Some original work has also been accomplished in plant chemistry, plant pathology, and paleobotany.

Colored Illustrations of Plants

By means of the income of the Addison Brown Fund, referred to in my last annual report, the preparation of the first part to be published of the magazine established by that fund for the publication of colored plates of plants of the United States and of other plants flowering in the collections of the New York Botanical Garden is now complete, and it is proposed to issue this first part during the

* See Jour. N. Y. Bot. Gard. **16**: 113–116.

year. The work is planned as a quarterly to appear every three months, each part to contain ten plates and accompanying letterpress. The bequest of Judge Brown establishing this fund contemplates the maintenance of this magazine by its income, aided by subscriptions to the work, and such subscriptions will therefore be invited.

Cooperation with the Horticultural Society of New York

Five exhibitions of plants and flowers were given in the museum building during the season in cooperation with the Horticultural Society of New York, the exhibits for the most part supplied by members of the Society, reinforced to some extent from our collections, opening on Saturday afternoons and extending through the following Sundays. Prizes, awarded by the exhibition committee of the Horticultural Society, were paid by the Garden from the income of the William R. Sands Fund. We also took part in the International Flower Show held under the auspices of the Horticultural Society and of the New York Florists Club at the Grand Central Palace in March. Further cooperation was arranged during the year for the installation of special horticultural plantations, the Horticultural Society to provide the plants, maintenance to be effected by us. Plans for a rose garden, the first of these collections to be planted, are now receiving your consideration. At your meeting of April 15, 1915, the Horticultural Society was granted permission to occupy rooms in the mansion for offices, and subsequently contributed money for the renovation of these rooms and supplied them with furnishings; Mr. George V. Nash, our Head Gardener, has been Secretary of the Society for several years, and this arrangement provides the Society, for the first time, with office facilities. The members of the Society were accorded the privileges of the board room in the mansion and contributed to the renovation and decoration of these rooms, and a leading part in designing and carrying out the decorations was taken by members of the Women's Auxiliary

of the Society in consultation with members of the Women's Auxiliary of the Garden.

Cooperation with the Bronx Society of Arts and Sciences

At the time the mansion came under our control with the additional land early in the spring, space in some of the rooms was occupied by the museum collections of the Bronx Society of Arts and Sciences, under a permit from the Park Department. Through action taken by you at the meeting of April 15, this occupancy was continued. This Society was, at that time, completing arrangements with the Metropolitan Museum of Art for a loan collection of paintings by American artists. The Society contributed money for the renovation and decoration of a room on the second floor to contain these paintings, the decoration being planned by officers of the Art Museum, and the paintings were subsequently installed. Members of this Society have also been given the board room privileges in the mansion.

Cooperation with the New York Association for Improving the Condition of the Poor

Early in the year, a proposition was received from the Association for Improving the Condition of the Poor offering to provide money for the payment of day laborers to be sent by this association, the money to be disbursed by administrative officers of the Garden, and the proposition was accepted, men out of employment being sent to us each week for two or three days. The plan was commenced on March 1 and continued until November 22, a maximum of 51 different men being sent the first week and the number diminishing to 2 during the thirty-ninth week. The total number of different men given work through this arrangement was 196, who made 2,722½ days' time, an average of 13.88 days for each man, and we disbursed, at the rate of $2.00 a day payment, $5,445. They were employed in many kinds of work, including cutting of trees,

excavation of stumps, trenching, rock excavation, caring for lawns, and painting.

The Association entered upon the agreement in the belief that the method of distributing money offered a way of relieving the distress in which many men found themselves by reason of unemployment, and that the work would add to the general attractiveness and usefulness of the Garden reservation. The experiment was a success in so far as the distribution of money for work accomplished was concerned, a great deal of distress was relieved, and considerable work of advantage to the Garden was accomplished. Administratively, it is estimated that the services rendered by these men was not more than 60 per cent. of what the expenditure of the same sum for trained laborers working consecutively would have accomplished.

Cooperation with Garden Clubs

Requests have been received from many garden clubs in the eastern part of the country for lecturers at their meetings and other aid or cooperation. It has not been possible to spare employees for these purposes, but, recognizing the desirability of associating the institution with these organizations, Mrs. Britton has addressed the garden clubs of Staten Island; Bedford, Westchester County; Shedowa on Long Island; and Larchmont, Westchester County; and both she and I spoke at a meeting of the Lenox Garden Club of Massachusetts. The increasing interest in gardening and the formation of new garden clubs from time to time make it desirable that further cooperation of this kind be arranged, but the duties of our present staff scarcely permit us to enter upon it.

Women's Auxiliary

A meeting of the Women's Auxiliary was held at the residence of Mrs. James Roosevelt on the afternoon of April 15, and at this meeting I delivered an illustrated lecture on "Spring Gardening and Spring Flowers." The

spring inspection of grounds, buildings, and collections on May 6 and the autumn inspection on October 21 were organized by the ladies of the Auxiliary. A committee of the Auxiliary on membership to cooperate with the Membership Committee of the Board of Managers has been appointed.

Administrative

Details of maintenance have been largely referred to Dr. W. A. Murrill, Assistant Director, and to Mr. R. S. Williams, Administrative Assistant, under my immediate supervision. I have also supervised all new construction, which has been under the immediate direction of Mr. Arthur J. Corbett, Superintendent of Buildings and Grounds, and Mr. John Finley, Foreman Gardener. Mr. George V. Nash, Head Gardener, has had immediate direction of the collections of living plants and the formation of new plantations, and the care and increase of the museum and herbarium collections has been under the immediate direction of Dr. John K. Small, Head Curator. The care and development of the additional land and additional buildings has not required the appointment of additional administrative officers, but the salaries of Mr. Corbett and Mr. Finley were slightly increased in recognition of the additional responsibilities entailed.

My own time, beyond that required administratively, has been given to a continuation of the investigation of the cactus family in cooperation with Dr. J. N. Rose, of the Carnegie Institution of Washington, and to a continuation of my studies on the flora of the West Indies.

Financial Considerations

The necessity for retrenchment in expenditures by the city caused a reduction of the appropriation for maintenance from $107,163 in 1915 to $100,075 for 1916. This will necessitate a restriction in our expenditure, and the use of nearly all our income from endowment and from membership dues to supplement the city allowance, leaving

us little for educational work or the increase of the collections. The necessity of caring for the 140 acres of additional land makes the financial condition very difficult. At your meeting of November 18, the Scientific Directors were authorized to invite subscriptions to funds aggregating $15,000, for aid in the maintenance and development of the new land and for the purchase of books, plants, and specimens; it is hoped that these funds may be obtained. It is also hoped that the number of Annual Members of the institution may be increased, and it is planned to invite, on behalf of the Membership Committees, a large number of persons to qualify as Annual Members.

Reports Appended

Appended reports include those of the Assistant Director, the Head Gardener, the Head Curator of the Museums and Herbarium, the Director of the Laboratories, the Superintendent of Buildings and Grounds, the Librarian, the Bibliographer, the Honorary Curator of the Economic Collections, the Honorary Curator of the Collection of Fossil Plants, and the Honorary Curator of Mosses; also a list of subscriptions to the Garden Extension and Commemoration Fund, and a schedule of expenditures by the Accountant.

Respectfully submitted,

N. L. Britton,

Director-in-Chief.

REPORT OF THE ASSISTANT DIRECTOR

Dr. N. L. Britton, Director-in-Chief.

Sir: I have the honor to submit the following report for the year 1915.

The reports to follow comprise the chief details of maintenance and I have submitted for your files the weekly reports of the Superintendent of Buildings and Grounds.

The season of 1915 must be recorded as the best general growing season in the history of the Garden. There were

heavy rains and floods in January and February and before February was over the frost was out of the ground except in shaded places. The summer and autumn were remarkable for plentiful and timely showers, the lawns remaining green throughout without artificial watering.

Mosquitoes were more prevalent this season than formerly, owing partly to the favorable season and partly to the fact that the frequent heavy rains removed the oil used in combatting them. The elm leaf beetle was almost entirely absent. The tent caterpillar was very abundant in the early spring but was so thoroughly destroyed that it has been difficult to locate an egg cluster about the grounds. The damage from the hickory bark beetle was very slight. The ash borer continues to be destructive, although all known means have been employed to prevent its spread. One new insect, the European pine-shoot moth, detected by Dr. Seaver, caused some damage to the dwarf pines. This insect is comparatively new to the country, and by prompt action we hope to keep it in check. The more easily combatted insects, such as scales, have been held in check by spraying with the usual contact poisons.

Publications

Journal

The *Journal* has been published for each month during the year, making a volume of 264 pages, with 23 plates and a map showing the recent addition to the Garden.

Mycologia

This periodical has appeared on alternate months during the year, making a volume of 357 pages, with 23 plates and 13 figures.

North American Flora

Volume 9, part 4, containing descriptions of Agaricaceae (pars), by Gertrude S. Burlingham, W. A. Murrill, and L. H. Pennington, appeared April 30, 1915.

Volume 34, part 2, containing descriptions of the family Carduaceae, by P. A. Rydberg and H. M. Hall, appeared July 28, 1915.

Volume 17, part 3, containing descriptions of the family Poaceae (pars), by G. V. Nash and A. S. Hitchcock, appeared December 20, 1915.

Bulletin

Bulletin No. 32, with 83 pages, was issued March 31, 1915. It contains the annual reports of the Director-in-Chief and other officers for the year 1914.

Memoirs

Volume V. Flora of the Vicinity of New York, by Norman Taylor. vi + 683 pp., with 9 plates, was issued January 30, 1915.

Contributions

No. 174. West Indian Mosses—II. Mosses of the Danish West Indies and Virgin Islands, by Elizabeth G. Britton.

No. 175. The Vegetation of Mona Island, by N. L. Britton.

No. 176. Phytogeographical Notes on the Rocky Mountain Region—IV. Forests of the Subalpine and Montane Zones, by P. A. Rydberg.

No. 177. Mosses of Bermuda, by Elizabeth G. Britton.

No. 178. Notes on Rosaceae—IX, by P. A. Rydberg.

No. 179. Studies of West Indian Plants—VI, by N. L. Britton.

No. 180. Mosses from the West Coast of South America, by R. S. Williams.

No. 181. The Origin of Dwarf Plants as shown in a Sport of Hibiscus oculiroseus, by A. B. Stout.

No. 182. Notes on Rosaceae—X, by P. A. Rydberg.

No. 183. Studies of West Indian Plants—VII, by N. L. Britton.

No. 184. Mosses of the Philippine and Hawaiian Islands Collected by the Late John B. Leiberg, by R. S. Williams.

No. 185. Phytogeographical Notes on the Rocky Mountain Region—V. Grasslands of the Subalpine and Montane Zones, by P. A. Rydberg.

Lectures

Public Lectures

Illustrated public lectures on botanical subjects have been given in the museum building on Saturday afternoons from April to the middle of November, as outlined below. The total attendance for the year has been 3,040, averaging 88 for each of the 34 lectures; the maximum attendance being 215 on June 5 and October 16.

April 3. "The Sources of Quinine," by Dr. H. H. Rusby.

April 10. "Growing Seeds for the Farm and Garden," by Dr. A. B. Stout.

April 17. "Botanical and Scenic Features of the Himalayas," by Mr. R. R. Stewart.

April 24. "The Development of the Vegetation of New York State," by Dr. W. L. Bray.

May 1. "The Vegetation of Porto Rico," by Dr. N. L. Britton.

May 8. "Flowers for the Spring Garden," by Mr. G. V. Nash.

May 15. "How to Collect and Study the Local Fungi," by Dr. W. A. Murrill.

May 22. "The Sea Gardens of the Tropics," by Dr. M. A. Howe.

May 29. "Destructive Insects," by Dr. F. J. Seaver.

June 5. "A Rose Garden for Every Home," by Mr. Robert Pyle.

June 12. "Dwarf Fruit Trees for Suburban Homes," by Prof. F. A. Waugh.

June 19. "Philippine Fiber Plants and Their Uses," by Mr. Theodore Muller.

June 26. "The Upper Delaware Valley and Its Flora," by Mr. G. V. Nash.

July 3. "Some Interesting Plants of the Rocky Mountains," by Dr. P. A. Rydberg.

July 10. "The Poisonous Plants of the Eastern United States," by Dr. William Mansfield.

July 17. "Botanic and Scenic Features of the Dells of the Wisconsin River," by Dr. A. B. Stout.

July 24. "Botanizing on the Austro-Italian Border," by Dr. W. A. Murrill.

July 31. "The Library of the New York Botanical Garden," by Dr. J. H. Barnhart.

August 7. "Flowers of Late Summer," by Dr. N. L. Britton.

August 14. "Fighting the Gypsy Moth," by Dr. W. E. Britton.

August 21. "Fungous Diseases in the Flower Garden," by Dr. Mel T. Cook.

August 28. "The Agriculture of the North American Indians," by Dr. A. B. Stout.

September 4. "The Possibilities of Nut Growing in New York," by Dr. W. C. Deming.

September 11. "The Use of Mushrooms for Food," by Dr. W. A. Murrill.

September 18. "Flowers That Should Be Planted in the Fall," by Mr. G. V. Nash.

September 25. "Some Economic Uses and Possibilities of Seaweeds," by Dr. M. A. Howe.

October 2. "Collecting Fleshy Fungi on the Upper St. Regis," by Dr. W. A. Murrill.

October 9. "Explorations in Haiti, the Negro Republic," by Mr. G. V. Nash.

October 16. "Life Zones in the Rocky Mountains," by Dr. P. A. Rydberg.

October 23. "The Fossil Plant Collections of the New York Botanical Garden," by Dr. Arthur Hollick.

October 30. "Correlations between Animals and Plants," by Dr. F. J. Sveaer.

November 6. "The Sources of Quinine," by Dr. H. H. Rusby.

November 13. "European Influences in American Botany," by Dr. J. H. Barnhart.

November 20. "The Diatoms," by Dr. M. A. Howe.

Docentry

Under the guidance of Mr. Percy Wilson, Mr. R. S. Williams, and Mr. H. W. Becker, who were detailed for docentry, over 1,200 visitors availed themselves of this special opportunity provided by the Garden each week-day afternoon during the year for viewing the collections, grounds, and buildings. Many classes from various schools in the city have also applied for special botanical instruction and demonstration.

Nature Study

The largest group of children that came to the Garden during the year was composed of about 10,000 members of the Bedtime Stories Club of *The Globe*, which held its first meeting here on September 20. Nearly 5,000 adults accompanied the children on this occasion.

Scientific Meetings

The monthly conferences of members of the staff and students have been continued, and a report of each meeting has been published in the current numbers of the *Journal.*

The Torrey Botanical Club has met each month as usual in the morphological laboratory in the museum building.

The Horticultural Society of New York, in cooperation with the New York Botanical Garden, held exhibitions of plants and flowers in the museum building on May 8 and 9, May 15 and 16, June 5 and 6, June 26 and 27, and August 15 and 16. Accounts of these exhibitions were published in the *Journal.*

A field meeting of the department of botany of the

Brooklyn Institute of Arts and Sciences was held at the Garden on the afternoon of May 22, when a tour of inspection was made of the conservatories, plantations, and museum building.

The Twentieth Anniversary of the New York Botanical Garden was commemorated during the week of September 6–11. Three days were devoted to meetings at the Garden and three to excursions in the vicinity of New York City.

The annual meeting of the Women's National Agricultural and Horticultural Association, with an exhibit of members' work, was held at the Garden under the auspices of the Horticultural Society of New York on May 7.

Panama Exhibit

The Garden's exhibit at the Panama-Pacific Exposition was completed early in January and transmitted to Mr. Fouquet for shipment to the New York Building at San Francisco. It contained the following:

1. A special set of bound Garden publications, to which current numbers were added during the year.

2. A screen with over 20 enlarged photographic views of the buildings and grounds.

3. A colored wall map and several special features shown in large frames to be hung in the halls adjoining the main exhibit.

4. Two swinging frames containing information about the Garden and its activities.

Personal Investigations

A part of *North American Flora* containing descriptions of 348 species of the higher fleshy fungi, 92 of which were new, was published in April. I was assisted in this work by Dr. Gertrude S. Burlingham, who supplied descriptions of *Russula*, and by Dr. L. H. Pennington, who supplied descriptions of temperate species of *Marasmius*. Two other parts of *North American Flora* are in preparation and I hope to complete them during 1916.

The last week in August was spent in the Adirondacks, where I obtained over 300 species of fungi for the herbarium, besides making both a qualitative and a quantitative survey of the region about Upper St. Regis Lake. An increasing number of fungi from all parts of North America are being sent in for determination and, in this way, the Garden receives many new and critical species. A total of 90 new species, 5 new genera, and 1 new tribe has been published by me during the year.

Work on the local fungous flora is still in progress, and Miss Eaton has prepared under my direction 77 additional plates of fleshy fungi for the museum. The popular illustrated articles on fungi in *Mycologia* have been continued with the aid of colored plates, 26 species having been treated in this series during the year.

Respectfully submitted,

W. A. MURRILL,
Assistant Director.

REPORT OF THE HEAD GARDENER

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to submit herewith my report as Head Gardener for the year 1915.

Systematic Plantations

HERBACEOUS GROUNDS. The collections here are contained in 130 beds, 26 east of the brook and 104 west. The old bed for the trillium family was canceled, a new and larger one being prepared in another place. There are in the herbaceous collections about 3,055 species and varieties. In addition to these, 42 species not represented here have been cultivated in the American wood garden. 557 individual show labels have been added.

Mr. K. R. Boynton, Head Gardener's Assistant, has had charge of the details of the curatorial work here and in the other herbaceous collections.

FRUTICETUM. There are in this collection 2,781 specimens,

representing, including those still at the nurseries, 52 families, 135 genera, and 914 species and varieties. In addition to these, there are in the American wood garden 6 genera and 6 species not in the fruticetum. There have been 873 individual show labels placed here.

SALICETUM. In the willow collection, 135 specimens represent 47 species and varieties.

DECIDUOUS ARBORETUM. This collection, including those native to the tract and still in the nurseries, contains 340 species and varieties. There are 1,035 individual trees, representing 31 families and 57 genera. 200 show labels have been made for this tract. The acquisition of the new land gives a larger area for the development of the deciduous arboretum. It is now planned to place the willow and walnut families south of the old south boundary, and the first move in this change was effected in the fall by the planting of a number of poplars. Later, the willows and poplars will be moved from their present position to this new land. The birch family will occupy the area east of the main driveway from its present location to the old south line of the Garden, the beech family occupying the region to the west of this, with the same north and south boundaries. This will give more room to the collections of birches and alders and to the oaks, which are becoming crowded.

PINETUM. The collection of conifers contains about 1,525 specimens. There are 303 species and varieties, representing 3 families and 20 genera. 165 show labels have been placed here.

VITICETUM. About 50 species and varieties of climbers are represented here.

CONSERVATORIES. The collections of tender plants comprise about 9,240 species and varieties, representing 207 families and 217 genera. The total number of plants in the public conservatories is 17,364.

Range 1. There are 10 662 plants in this range, distributed as follows: house 1, 286; house 2, 400; house 3,

465; house 4, 587; house 5, 1,399; house 6, 510; house 7, 980; house 8, 684; house 9, 144; house 10, 808; house 11, 486; house 12, 1,153; house 13, 520; house 14, 630; house 15, 1,459; cellar, 151. For this range, 1,290 show labels have been made.

Range 2. There are here 6,702 plants, distributed as follows: house 1, 63; house 2, 160; house 3, 86; house 4, 1,353; house 5, 2,075; house 6, 1,587; house 7, 1,302; runway, 76. There have been 840 show labels made for this range.

PROPAGATING HOUSES AND NURSERIES. There are here, excluding those used for special studies by the Director-of-the-Laboratories, 9,959 plants. There have been 790 packets of seeds received, as follows: gift, 18; purchase, 422; exchange, 277; collected, 73. In addition to the above, 812 packets have been collected on the grounds. House 2 and parts of other houses have been used by the Director-of-the-Laboratories for his experiments and those of his students. Houses 5 and 6 and a part of house 1 contain the cactus and other succulent collections. The enclosure in the nursery, together with increased areas outside, have been used by the Director-of-the-Laboratories and students.

LABELING, RECORDING, and HERBARIUM. Accession numbers 41,482 to 43,628 have been recorded, making a total of 2,147 accessions. Show labels to the number of 5,498 have been made, as follows: deciduous arboretum, 200; fruticetum, 873; herbaceous grounds, 557; economic garden, 61; morphologic garden, 18; west border, 20; pinetum, 165; trees along roads and paths, 631, 116 of these in the old portion of the grounds, 515 in the new; conservatory flower beds, 777; flower beds, elevated railway approach to conservatory, 27; conservatory, range 1, 1,290; conservatory, range 2, 840; conservatory court, 8; aquatic garden, 31.

The following plants have been acquired: by gift, 8,619 (of which 8,374 are bulbs), valued at about $1,857; by

exchange, 350; by purchase, 16,300, including 11,005 bulbs; by collections made by members of the staff and others, 2,562; derived from seeds from various sources, 1,267; total, 29,098.

The herbarium of cultivated plants has been increased by about 1,250 specimens. The collections contain approximately the following number of species and varieties: conservatories, 9,240; herbaceous grounds, 3,055; fruticetum, 914; salicetum, 47; deciduous arboretum, 340; pinetum, 303; viticetum, 50; total, 13,949.

Miscellaneous Collections

Under this heading are contained: the morphologic garden; the economic garden; the collections of desert plants placed during the summer in the court of conservatory range 1; the conservatory lily pools; the aquatic garden; the rhododendron banks in the vicinity of the lakes; the rose bed, east of conservatory range 1; the flower gardens in the immediate vicinity of conservatory range 1, at the elevated approach, the west border, and along the path from the elevated railway to the conservatory; and groups of shrubbery in many parts of the grounds.

During the spring, a new collection of rhododendrons was started at conservatory range 1 by aid of the John Innes Kane Fund. This is located on the north side of the range, the west end, and contains 176 plants, representing 16 kinds.

American Wood Garden. On a wooded easterly slope between the fruticetum and the low-lying ground bordering the river, a collection of American wood-loving plants was started. There were 1,727 specimens installed here, representing about 123 species, mostly acquired by purchase. Most of them did very well, but it will require the test of a winter and summer to decide which will survive in this climate.

General Horticultural Operations

The following force has been available for carrying on this work: monthly, 2 foreman gardeners, 23 gardeners, 1 garden aid, 3 drivers for the mowing machines, and 2 drivers for the wagons; laborers, 24–28.

John Finley, foreman gardener in charge of the outside work, was assigned 7 gardeners, 24–28 laborers, including 4 employed in cleaning the walks, and the drivers.

H. W. Becker, foreman gardener, has been in immediate charge of the work in the conservatories and propagating houses, with 16 gardeners and 1 garden aid.

The following new work has been accomplished, in addition to the regular routine operations:

In the Spring

The banks on both sides of the river at the Linnaean bridge were planted with willows. The west bank of the river, north of the Linnaean bridge, was planted with oaks and maples. The stone wall along the road leading north from the mansion was planted with trumpet-flower vines.

The most important piece of work accomplished was the establishment, early in May, of a plantation of 176 rhododendrons, representing 16 kinds. This was accomplished by means of the income from the John Innes Kane Fund. These plants have done exceedingly well during the past summer.

In the Fall

A decorative plantation, consisting of Japanese holly, box, and conifers, was established at the east entrance and along the south side of the mansion. The principal work during the fall was the planning and partial establishment of the decorative planting at the southwest entrance. A border of evergreens will be placed along the Southern Boulevard and Pelham Ave, in front of which there will be an area planted with deciduous shrubs, with a ten-foot herbaceous border paralleling the paths. Iris will be given a prominent place here, making of it primarily an

iris garden. The rear half of each herbaceous border, with occasional areas in front for the smaller species, will be allotted to this flower. In front of the irises it is planned to grow bulbs, followed by annuals and greenhouse plants. Considerable of the planting of deciduous shrubs has already been accomplished. In the border along the west path, 1,550 tulips have been planted, given by John Scheepers & Company, Inc., and in the border along the path extending to the east, 1,920 tulips were installed. This is only sufficient to plant a part of the area here intended for bulbs.

In the various decorative plantations, 31,128 bulbs have been planted, 8,374 of these being the gift of John Scheepers & Company, Inc. These were distributed as follows: beds in the conservatory court, 12,900; fountain at the foot of the museum approach, 2,200; iris garden, 3,470; for replacement in groups which were becoming depleted, 5,576; bed in conservatory plaza, range 1, 2,900; the remainder in various groups of shrubbery.

Investigations and Lectures

In addition to routine duties, I have continued my studies upon the orchids for *North American Flora*, and have given much time to horticultural botany.

I have also given four lectures in the regular courses of public lectures at the Garden, and have superintended the making of colored drawings for *Addisonia*.

Respectfully submitted,

GEORGE V. NASH,
Head Gardener.

REPORT OF THE HEAD CURATOR OF THE MUSEUMS AND HERBARIUM

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I submit the following report as Head Curator of the Museums and Herbarium for the year 1915.

The several collections under my supervision were en-

larged by specimens from various parts of the world. The methods of conservation used in past years were continued.

ACCESSIONS. Detailed accession lists of the museum and herbarium specimens received during the year were published from month to month in the Garden *Journal*. Although many important specimens came from the Old World, the great bulk of the material received came from continental and insular America. The appended table indicates the amount of material brought together:

By gift and purchase	7,568
By exchange	13,341
By exploration	15,368
Total number of specimens	36,277

The value of the gifts is estimated at $39.20. Fully 4,000 duplicate specimens were sent to other institutions and to individuals in exchange for other specimens.

Museums

The museum equipment was not augmented. Many exhibits of the several divisions of the museums were enlarged by the addition of new specimens.

FOSSIL PLANT MUSEUM. Specimens from Canada and the northeastern United States were added to this collection, and investigations on several lines of work previously inaugurated were continued. In order to make the public exhibits of fossil plants more intelligible to the visiting public, illustrations of restorations of carboniferous plants and landscapes were installed with the specimens. The complete labeling of the collections was accomplished during the year.

ECONOMIC MUSEUM. Many parts of this collection were augmented by the interpolation of new specimens. The shifting of several exhibits was necessitated both by unequal growth of exhibits and congestion. The exhibits were arranged in as permanent positions as possible, in contemplation of the new edition of the *Guide Book*. This collection was entirely renovated and all seriously deteriorated

specimens removed. The most important additions were the specimens of drug-plants and of food-plants brought together by Dr. H. H. Rusby.

SYSTEMATIC MUSEUM. The elements of this museum were not essentially changed during the year.

The Synoptic Collection was renovated throughout. Deteriorated specimens were removed and new ones added.

The Local Flora remained as in the preceding year. Additional miscellaneous specimens and many paintings of fungi have been prepared for installation.

The Microscope Exhibit was maintained as in the previous year, but it was renovated and fresh specimens interpolated.

The Plant Photograph Exhibit was neither changed nor augmented.

Herbaria

The herbarium equipment was not increased during the year. Considerable shifting of specimens was necessitated by the uneven increase of the families and the genera in the various major groups of plants.

Current exsiccati representing most of the plant-groups were received as heretofore. Miscellaneous specimens from many parts of the world were added to the collections. Large and important collections of both marine and fresh-water algae came from continental North America and from Porto Rico, Cuba, Newfoundland, and South America. The additions of fungi and lichens consisted of the Gerard herbarium of lichens, and miscellaneous collections from continental North America, South America, and the West Indies. The hepatics and mosses came from a wide range of territory; the more important collections, in addition to the miscellaneous specimens from the herbarium of M. A. Howe, coming from various parts of continental North America, the West Indies, Colombia, Ecuador, Peru, Brazil, and Argentina, and from Europe, continental Asia, the Philippine Islands, and Hawaii. The ferns represent a miscellaneous collection from North America

and the specimens from the Alwin Berger herbarium. The flowering plants for the general herbarium, in addition to those from several parts of the United States, came mainly from Canada, Mexico, Cuba, Porto Rico, Jamaica, and the Philippine Islands.

The herbarium comprising the local flora was materially increased by the addition of specimens collected within the hundred mile limit both by members of the staff and by others.

Selections from specimens received during the year and previously, about 43,000 specimens of flowerless and flowering plants, were added to the herbarium. About 23,000 sheets of herbarium paper were used, and a number of bulky specimens not suitable for keeping on sheets were filed away in cardboard boxes.

The lichen herbarium was developed and many heretofore stored portions were made accessible through the voluntary assistance of Mr. W. C. Barbour, who personally devoted much time and attention to the work.

Specimens received for the Columbia University herbarium were mounted and incorporated in that collection.

Assistance and Investigations

Dr. P. A. Rydberg, Curator, had charge of the herbarium collection of flowering plants, as in previous years. He continued his monographic work on the family Carduaceae for *North American Flora*, and a second part, containing genera of this family, was issued in July. A third part is nearly ready for publication. He also began monographic work on the family Fabaceae. Dr. Rydberg devoted a little attention, in continuation of former work, to the plants of the Rocky Mountain region, and prepared and published two papers, "Phytogeographic Notes on the Rocky Mountain Region IV. and V." Two studies on Rosaceae, left over from preceding years, were also printed. A paper on the "Life Zones in the Rocky Mountains" was prepared for the Twentieth Anniversary of the Garden,

at which time a short abstract was presented; but the paper was presented in full before the Torrey Botanical Club and the Department of Botany at Columbia University. Dr. Rydberg also gave one lecture in the public lecture course of the Garden.

Dr. Marshall A. Howe, Curator, continued to have charge of the collections of algae and hepaticae. In both of these groups, considerable additions were made to the herbarium. An acquisition of some importance was the collection of hepaticae brought together and formerly owned by Dr. Howe, which was presented to the Garden by Miss Caroline C. Haynes. Dr. Howe devoted about four weeks in June and July to making collections and field studies of marine algae in Porto Rico in connection with a general natural history survey of that island. A brief account of this expedition has been published in the Garden *Journal* for October. In addition to reviews, Dr. Howe published descriptions of new species of *Riccia* from Porto Rico and completed a report on fossil calcareous algae of the Leeward Islands for publication by the Carnegie Institution of Washington. He continued to act as a member of the editorial board of the Torrey Botanical Club and gave three lectures in the Garden lecture courses. He also presented a paper at the recent New York meeting of the National Academy of Sciences.

Dr. Fred J. Seaver, Curator, had general oversight of the fungous collections, and published during the year several papers which are preliminary to monographs for *North American Flora*, a part of which prepared by him is nearing completion. During the summer and autumn, he devoted some time to the collection and study of local fungi, especially the fleshy discomycetes, this work being supplementary to the herbarium work for *North American Flora.* He has also continued his studies and collection of local insect pests, especially those affecting shade trees, and has continued to act as associate editor of *Mycologia.* Dr. Seaver gave two lectures in the Garden lecture courses.

Mr. Percy Wilson, Associate Curator, continued to devote his attention to the determination and distribution of various collections of West Indian plants. He has had the supervision of the lantern-slide and photographic negative collections; also of all photographic work. In addition to his duties as docent three afternoons each week, Mr. Wilson had the care of all extra visiting classes from various schools. As chairman of the field committee of the Torrey Botanical Club, he has arranged for all weekly field meetings of the Club, was personally present at most of the field excursions, and obtained in this way much valuable material illustrating the local flora.

Dr. Francis W. Pennell, Associate Curator, in addition to general herbarium work, continued several lines of investigation commenced last year. For the study of the Scrophulariaceae he has typified all genera of the family, and has fully indexed, mostly with statement of type locality, the literature to original descriptions of American species. Nearly three months, from June 1 to August 25, he spent in field study of this family, mainly in the central Rocky Mountain region. Dr. Pennell has also continued the study of collections made in 1912 and 1913 in the southern states, and in connection with this revised the United States species of several genera of some complexity, *Commelina*, *Schoenocaulon*, *Nemexia*, *Chamaecrista*, and *Crotonopsis*.

Miss Margaret Slosson, Assistant Curator, cared for the fern herbarium during the year and continued exchanges with the herbaria of Prince Roland Bonaparte, by means of which rare ferns and Mexican flowering plants were added to the collections. She began a series of papers as the result of studies on the Hymenophyllaceae, the first appearing during the year and two others being nearly ready for publication, and she practically completed a check list of the fern flora of Porto Rico, listing the distribution of the species. Miss Slosson also read a paper on the "Value of Leaf-hairs in Determining Fern Species" at one of the

Garden conferences, and presented a paper on American filmy ferns at the Twentieth Anniversary of the Garden.

Dr. H. H. Rusby, Honorary Curator of the Economic Collections, continued to develop the collections of the economic museum. For details, see his report.

Mrs. N. L. Britton, Honorary Curator of Mosses, continued to care for and develop the collection of mosses, with the cooperation of Mr. R. S. Williams. Her report appears elsewhere in this publication.

Dr. Arthur Hollick, Honorary Curator of Fossil Plants, continued, with the cooperation of Mr. Edwin W. Humphreys, the work he initiated in former years. For particulars, see his report.

The writer, in addition to regular curatorial duties, continued his studies on North American plants, particularly those of the southeastern United States. Especial attention was given to the plants of southern Florida and two periods of field work and study were devoted to the little-known parts of tropical Florida, particularly on the Everglade Keys and on the Florida Keys. This exploration brought to light undescribed endemic plants, West Indian plants new to the flora of the United States, and naturalized exotic plants. Specimens of these have been incorporated in our permanent collections and the duplicates are being sent to other institutions as exchanges.

Some monographic work on the family Polygalaceae for *North American Flora* was accomplished, both at the Garden and at Harvard University, and a paper on "Recent Exploration in Southern Florida" was presented at the exercises of the Twentieth Anniversary of the Garden in September.

Respectfully submitted,

JOHN K. SMALL,

Head Curator of the Museums and Herbarium.

REPORT OF THE HONORARY CURATOR OF THE ECONOMIC COLLECTIONS

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to submit below my report for the year 1915.

Work during the past year in connection with the economic museum has of necessity been restricted to receiving and caring for such materials as have been donated by friends of the Garden, and such as have been readily obtainable by ourselves. The additions to the collections consist almost wholly of rare food and drug products found in our eastern markets.

There has appeared during the year in the Garden *Journal* a somewhat comprehensive article on the fiber products of the Philippine Islands which throws an important light on our exhibit of these products.

I take this opportunity of again bringing to your attention the great importance of some more systematic method in the building up of this museum. In a botanical museum, the fundamental consideration is the vegetable kingdom, and our interest in useful products derived from it lies in their relations with individual plants and in the precise nature of such relations. While every effort has been made to establish and indicate these relations in connection with our exhibits, we have very often found it necessary to rely upon commercial information as to their sources, whereas the ideal method is that of having the relation of exhibits to species scientifically authenticated by both records and materials.

In the early history of the Garden, such methods were pursued in relation to our local flora, which is therefore very well represented in the manner indicated. The same method has been pursued incidentally, in connection with other work, during various expeditions in this and other countries. It is now very desirable that a systematic attempt should be made to secure a reasonably complete

representation of a similar character, first of the products of the United States territory, and later of other countries.

Respectfully submitted,

H. H. RUSBY,

Honorary Curator of the Economic Collections.

REPORT OF THE HONORARY CURATOR OF MOSSES

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: During the past year, 1,458 accessions to the herbarium of mosses have been made. Several large collections from the Philippines, Hawaii, and Brazil have been received from the United States National Museum. Our own collections in Porto Rico and those of our correspondents in Cuba and Jamaica continue to prove valuable additions. Miss Borkland has been mounting the remnant of the exotic mosses from the Mitten herbarium. No attempt has yet been made to distribute the duplicates, but 505 duplicate West Indian specimens of hepatics and lichens have been sent to Dr. Riddle and Dr. Evans for naming and 279 named mosses to other institutions. A descriptive list of the mosses of Bermuda, with illustrations by Miss Eaton, has been prepared and studies of the genus *Fissidens* have been continued.

In preparation for the next two parts of Volume 15 of *North American Flora*, Mr. Williams also has been studying the Calymperaceae and Pottiaceae and Dr. A. LeRoy Andrews, of Cornell University, has been assisting us with several troublesome genera. Mr. Williams has devoted considerable time to naming the South American collections made by Dr. and Mrs. Rose and the Philippine and Hawaiian mosses collected by Mr. J. B. Leiberg.

During March and April, 525 letters, notices, and schedules were sent to the principals of the public schools of Greater New York, notifying them of the Stokes' prize arbor-day competition for the protection of our native plants. Thirty framed pictures, each containing reproductions in color of eight native wild flowers, were awarded and three

prize essays printed and distributed. In Public School 76, a junior park league was organized and pledges were signed and given to Park Commissioner Ward at the graduating exercises held in Hunter College. Several of the schools of The Bronx have been visited by me and short addresses made to the pupils, calling their attention to the notice issued by Mayor Mitchel, which was posted in all the parks of Greater New York. The notice reads, as follows:

ORDER BY THE MAYOR

One of the ordinances or laws of this city forbids all persons to throw or in any manner deposit on the walks, benches, lawns, or on the earth in any of the public parks, any newspaper, waste paper of any kind, peanut shells or other rubbish. The park and police authorities will vigorously enforce this ordinance.

(Signed) JOHN PURROY MITCHEL, *Mayor*,
City Hall, N. Y.

May 1st, 1915.

Following these instructions, the police and park authorities made many arrests and the result has been a great improvement in all the parks of Greater New York.

On April 24th, I was invited to address the Nature Study Club of the School Garden Association at their annual luncheon at the Hotel Majestic, at which over 300 teachers and principals were in attendance, and used the opportunity to ask their cooperation in the protection of our native plants and city parks. I have also given illustrated lectures before the garden clubs of Larchmont, Bedford, Staten Island, and Garden City and showed some of the Van Brunt slides of American wild flowers needing protection.

During the year, Miss Kittredge has colored for me and I have presented to the Garden 103 slides of North American wild flowers and other plants. I have also continued to act as secretary-treasurer of the Wild Flower Preservation Society of America.

Respectfully submitted,

ELIZABETH G. BRITTON,
Honorary Curator of Mosses.

REPORT OF THE HONORARY CURATOR OF THE COLLECTION OF FOSSIL PLANTS

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to report as follows upon the activities in connection with the paleobotanical work of the Garden during the year 1915.

The cataloguing of the type and figured specimens in the collections was continued by Mr. E. W. Humphreys and is now practically completed.

In order to add to the educational value of the museum exhibits, five photographic enlargements were installed in the cases of Paleozoic plants, representing restorations of some of the best known elements of the Carboniferous flora (*Lepidodendron*, *Sigillaria*, etc.).

One collection of Pleistocene plants from the Don River Valley, Ontario, sent by Professor A. P. Coleman, of the University of Toronto, was examined and reported upon and duplicate specimens retained for the Garden collection. Specimens of Cretaceous plants collected personally and by Mr. Humphreys at Glen Cove, New York, were subjected to preliminary examination and Mr. Humphreys, under my direction, made a study of all the unidentified Tertiary plants from Florissant, Colorado and supplied definite or tentative determinations for all the specimens.

About twenty specimens were received and accessioned and sixteen volumes and pamphlets were added to the paleobotanical library. All of my time which could be spared for the purpose was utilized in work on the fossil flora of Alaska for a forthcoming monograph of the United States Geological Survey. Two papers based upon this work were presented on September 9 in connection with the program of the Twentieth Anniversary Celebration of the Garden. It was also my privilege, on October 23, to deliver a lecture on the fossil plant collections of the Garden in the regular Saturday afternoon course.

Respectfully submitted,

ARTHUR HOLLICK,

Honorary Curator of the Collection of Fossil Plants.

REPORT OF THE DIRECTOR OF THE LABORATORIES

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to submit the following report for the year 1915.

The Laboratories

The arrangement and equipment of the laboratories have remained as in the preceding year and have been fully utilized for a considerable part of the year.

Experimental Garden and Greenhouses

The additional land which you added this year to the experimental plots has allowed some very desirable expansion of the experimental studies. All the facilities were fully in use. Additional greenhouse space would greatly facilitate investigations, especially those of students who wish to prosecute vigorously studies in heredity and pathology during the winter months and for which there is an increasing demand. For the study pursued by Mr. Cecil Yampolsky of the behavior of sex in *Mercurialis*, a large number of plants were grown, both in the plots and in the greenhouses. About 3,000 plants of *Primula* are being grown in the greenhouse and cold frames for study by Mr. Edgar Altenberg. The efforts to grow *Primula* solely as a summer crop have not been successful. Several new students have begun investigations during the past autumn. Professor R. A. Harper has continued his genetical studies of corn at the Garden.

Miscellaneous Duties

The meteorological records at the Garden have been taken throughout the year and monthly summaries published in the Garden *Journal*. I have planned the program of the various monthly conferences of the staff and students of the Garden, reports of which have been printed in the *Journal*. During the past year, I also have continued as editor of the *Journal*.

Personal Investigations

The results of the studies of bud variation in *Coleus*, which have been in progress since 1911, have, during the year, been published by the Carnegie Institution of Washington (Publication No. 218). Further studies are planned regarding seed progenies and the possibility of inducing variations. Chemical investigations of the pigments involved in the variegation are highly desirable and material for such study has been furnished to Dr. B. Horowitz, who is undertaking such a study under the direction of Professor W. J. Gies.

Cultures of *Verbascum Blattaria* have been continued for the study of the heredity of flower color. A large number of fasciated plants appeared in the cultures that were held over winter; this development evidently being induced by conditions of growth.

A third generation of pedigreed plants of *Cichorium Intybus* was grown during the year for a continuation of the investigation of self and cross sterility for which this plant is especially favorable. A report of the results thus far obtained was presented at the Twentieth Anniversary of the Garden and a complete report is now in preparation for publication in the near future. Statistical studies of the flower number in *Cichorium* were vigorously prosecuted during the summer, Miss Helene Boas, Mr. R. C. Faulwetter, Miss Friedolina Jud, and the writer participating in the work. Miss Boas has continued in the work of compiling this data, which we hope soon to report in complete form.

By means of a mulch, the cultures of *Hibiscus* were successfully carried through the winter of 1914–1915. These bloomed profusely, giving data on the behavior of various types of F1 hybrids. The appearance of an interesting dwarf type of *Hibiscus oculiroseus* has been reported during the year (Bull. Torrey Bot. Club **42**: 429–450). About 500 plants of the various cultures were removed from the plots this past autumn, and space thus obtained especially

for the F2 generation of various varietal and specific hybrids. I was unable, during the past summer, to leave the Garden for field study on the natural distribution of types of *Hibiscus Moscheutos* and *H. oculiroseus*, which is highly desirable and for which I already have your permission. I should like very much to plan for some such observation during the coming summer.

Observations have been continued on the variations that appear in the tulips grown for display. A preliminary morphological and cytological study of the cell conditions in the various stages of color development has been made, which promises interesting results. Material has also been supplied to Professor Gies and Dr. Horowitz for chemical studies of the flower pigments in tulips.

Hybrids between species of *Carex* started two years ago grew luxuriantly during the year, but only one plant came into flower. The cytological study of various species of *Carex* and of their hybrids has been a special subject of investigation by Mr. Faulwetter during the past year.

Students and Investigators

The following list includes the investigators who held research scholarships at the Garden, students originally registered at Columbia University and pursuing studies at the Garden, and tuition students of the Garden. For this year, all the last-named class also pursued some studies at Columbia University.

*Altenberg, Edgar. A.M., Assistant in botany, Columbia Univ.
Heredity of Primula and of various cereals.

†Arthur, Joseph Charles. Sc.D., Professor of vegetable physiology and pathology, Purdue Univ.
Taxonomy of the Uredineae.

Barbour, William Clay. B.S., Assistant teacher of biology, High School of Commerce, New York City.
Lichenology.

*Berman, Florence Julia. A.B., Teacher in Public School 10, New York City.
Genetics.

* Registered at Columbia University.

† Research scholarship.

*Darrow, Isabelle Caroline. A.B.
Genetics.
*†Faulwetter, Roy Christopher. A.B., Assistant in botany, Columbia Univ.
Cytology of various species and hybrids of Carex.
†Fromme, Fred Denton. Ph.D., Plant pathologist and bacteriologist, Agr. Exp. Station, Blacksburg, Virginia.
Taxonomy of the Uredineae.
Graff, Paul Weidemeyer. B.S.
Pathology. Mycology.
†Jud, Friedolina Catharina. A.M.
Palaeobotany. Genetics.
*Muller, Theodore.
Pathology.
*Nixon, Ernst Leland. M.S.
Genetics.
*Stewart, Eleanor Grace. B.S., Science teacher, Miss Chapin's School for Girls, New York City.
Cytology of the cacti.
*Stewart, Ralph Randles. A.B., Assistant in botany, Columbia Univ.
Taxonomy of the phanerogams of western Tibet.
*Stowell, Willard Allen. B.S., Instructor in science, High School, Elizabeth, New Jersey.
The oak hybrids of Cliffwood, New Jersey.
Taistra, Sophie Amy. B.A., Substitute teacher in biology, High School of Commerce, New York City.
Genetics. Cytology.
*Yampolsky, Cecil. B.S.
Cytology. Genetics.

Numerous investigators not mentioned in the above list have been at the Garden for various periods of time prosecuting special lines of research.

Respectfully submitted,

A. B. Stout,
Director of the Laboratories.

REPORT OF THE BIBLIOGRAPHER

Dr. N. L. Britton, Director-in-Chief.

Sir: I have the honor to submit the following report for the year 1915.

Assistance of persons consulting the library, bibliographic

* Registered at Columbia University.
† Research scholarship.

research, and the accumulation of bibliographic memoranda for ready reference, have continued to occupy a considerable part of the Bibliographer's time.

Comparatively few books have been purchased for the library during the year, and if the efficiency which has hitherto characterized the collections is to be maintained, it will be necessary eventually to expend considerable sums to make up for the inactivity of the last few years.

Three parts of *North American Flora*, aggregating 288 pages, have been issued during the year: Volume 9, Part 4, in April, Volume 34, Part 2, in July, and Volume 17, Part 3, in December. Two other parts are in press.

The Bibliographer has given two lectures in the public courses of the Garden, and presented a paper in connection with the Twentieth Anniversary Celebration in September; he also took charge of the registration of visiting botanists during the celebration.

Respectfully submitted,

JOHN HENDLEY BARNHART,

Bibliographer.

REPORT OF THE LIBRARIAN

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to submit the following report for the year 1915.

According to a census of the library taken at the end of the year, the number of bound volumes was found to be 27,224, an increase of 925 volumes since the report for 1914.

During the year 573 books have been bound, including 43 which are the property of Columbia University.

Among the accessions are 191 books acquired by purchase, and 47 by exchange and deposit. The gifts include the books on botany from the library of the late Judge Addison Brown, a list of which may be found in the June number of the *Journal*.

In February, a typewriter was purchased for the library. The use of this has greatly facilitated the work of cataloguing

which is now brought nearly up to date. There have been added to the catalogue during the past year 6,446 written and typewritten cards, in addition to the printed cards issued by the Torrey Botanical Club. The library has also acquired the cards thus far issued of the Index algarum universalis. The much-needed work of revising the catalogue will probably be undertaken in the near future.

A list of the publications received currently by the Garden was appended to the report of the Librarian for 1910 (*Bulletin* 7: 325–347), and was supplemented in later reports (*Bulletin* 8: 45, 213, 293) and (9: 46): further required alterations in the list are as follows:

Change the following:

Asmara, Ufficio Agrario Sperimentale, Asmara, Colonia Eritrea, N. E. Africa. *L'Agricoltura Coloniale* to
Florence, Istituto Agricolo Coloniale Italiano, Florence, Italy. *L'Agricoltura Coloniale.*
Colombia. Ministerio de Obras Publicas y Fomento, Bogota, Colombia. *Revista* to
Colombia. Ministerio de Agricultura y Comercio, Bogota, Colombia. *Revista Agricola.*
Mexico. Instituto Medico Nacional, Mexico, Mexico. *Anales* to
Mexico. Secretaria de Fomento, Colonizacion e Industria y Comercio. Direccion de Estudios Biologicos, Mexico, Mexico. *Boletin.*
Ohio State University: Biological Club, Columbus, Ohio. *Ohio Naturalist* to
Ohio State University Scientific Society, Columbus, Ohio. *Ohio Journal of Science.*

Omit the following:

American Agriculturist.
Household Journal and Floral Life.
Popular Science Monthly.

Add the following:

Algiers. Société d'Histoire Naturelle de l'Afrique du Nord, Alger, Algeria. *Bulletin.*
Florida State Geological Survey, Tallahassee, Fla. *Annual Report.*
Illinois. University of Illinois, Urbana, Ill. *Biological Monographs.*

Palisades Interstate Park Commissioners, New York, N. Y. *Report.*
Porto Rico. Commissioners of Agriculture, Insular Experiment Station, Rio Piedras, P. R. *Bulletin, Report.*
Pulp and Paper Magazine of Canada, Montreal, Canada.
Quebec Society for the Protection of Plants from Insects and Fungous Diseases. Quebec, Canada. *Annual Report.*
Cuba. Sociedad Cubana de Historia Natural "Felipe Poey," Havana, Cuba. *Memorias.*
South Africa. Union of South Africa. Department of Agriculture, Pretoria, S. Africa. *Agricultural Journal.*
*Arborea: Bulletin of the Massachusetts Tree Wardens and Foresters Association, Worcester, Mass.

Respectfully submitted,

SARAH H. HARLOW,
Librarian.

REPORT OF THE SUPERINTENDENT OF BUILDINGS AND GROUNDS

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to submit the following report for the year 1915.

Regulating and Grading

The bank on the western side of conservatory range 2 has been regulated, graded, and sown with grass seed in three places, one patch 15 feet wide and 130 feet long, another 75 feet wide and 150 feet long, and the third 15 feet wide and 150 feet long. Both sides of the path 15 feet wide and 400 feet long running northwest of conservatory range 2 along the driveway have been graded. Two strips of ground 12 feet wide, one 500 feet long, running north, and the other 250 feet long, running east, were regulated, graded, and subsoiled at the Pelham Avenue and Southern Boulevard entrance to the Garden. Both sides of the new road at the rose garden were regulated and graded, and in doing this about 1,400 yards of fill and top-soil were used. The bank south of the mansion, near the permanent steps, was regraded with 60 yards of fill.

About 4,000 cubic yards of soil were carted into the grounds by contractors working in the neighborhood of the

Garden who were looking for a place to dispose of it. This earth was deposited to our satisfaction at the contractors' expense. About 1,000 yards of the earth were placed north of the Woodlawn Road bridge, and about 3,000 yards were placed in the old quarry near the Pelham Avenue and Southern Boulevard entrance.

Nearly 4,800 yards of earth were removed in the construction of the new driveway at the rose garden, and about 3,500 yards of this earth were used to extend the driveway across the lake, the remaining 1,300 yards being used to grade both sides of this new drive. About 300 yards of topsoil also were removed from the paths at the iris corner to grade both sides of the new road through the rose garden and for grading near the mansion.

Drainage

For the construction of the deep drain at power house 2, we have added 44 feet of 8-inch pipe. We used 202 feet of 6-inch pipe to extend the catch-basin pipe to the river at the northwestern end of the long bridge. On the western side of the river near Pelham Avenue, 50 feet of 12-inch pipe were used to connect the culvert with the river, and 850 feet of 6-inch pipe have been laid through the old drain in the rose garden, to which two catch-basins have been connected. In laying this drain-pipe through the rose garden, we removed 700 feet of a stone wall from both sides of the old drain, the stone being used in the construction of the new road.

Roads and Paths

Two paths 10 feet wide and about 500 feet long have been lined at the entrance from Pelham Avenue and the Southern Boulevard, and 400 feet of these paths have been paved and prepared for screening. On the western side of the Bronx River north of the Linnaeus bridge, 1,600 feet of path have been lined ready for paving and a path 10 feet wide and 400 feet long, running northwest along the road

from conservatory range 2, has been lined and paved. The path on the eastern side of conservatory range 2 with two branches 8 feet wide and 61 feet long running south to the Allerton Avenue entrance, has been paved, covered with ashes, and is now ready for screening, and the unfinished path on the western side of conservatory range 2 also has been prepared for screening. The path running through the pinetum from conservatory range 1 has been completed. The path from the elevated railway approach to conservatory range 1 and the paths on the eastern and western sides of this range were resurfaced with screening.

The driveway through the rose garden, 30 feet wide and 250 feet long, has been lined and 75 feet of this road have been paved. Half of the semicircular road leading to the main entrance of conservatory range 2 has been lined and paved and is now ready for trap-rock.

Buildings

Considerable repairs were made at the mansion by the carpenters, painters, and plumber. One third of the roof has been reshingled, the porch on the southern side of the building has been repaired, and new sash cords and catches have been used in repairing the windows. The flooring and several of the doors have been repaired in different parts of the building. Picture moulding has been put up in two rooms on the second floor for the exhibition of paintings and engravings. The walls and all woodwork of four rooms on the first floor and four rooms on the second floor of the mansion have been repaired. Putty was renewed in the window sash and the sash and window frames have been painted. A steam heating plant extending to the second floor of the mansion and connecting nineteen radiators was installed by our plumber. Two sinks were also installed.

The plumbing work in comfort house 4 was repaired considerably and the water system was changed in comfort house 1. All repairs to the plumbing system were made by our own plumber.

Twenty-eight rustic benches and twelve tubs for plants in conservatory range 1 were made by the carpenters, in addition to the usual repair work. The lecture hall and one room in the basement of the museum building have been painted, and the exterior of conservatory range 1 from the stonework to the gutter has also been painted. The broken glass in all the buildings has been replaced by the painter. All necessary repairs to the steam heating system in power houses 1 and 2, conservatory ranges 1 and 2, and in the museum building have been made by the steam engineers.

Two large patches in the roof of the museum building have been repaired, and at conservatory range 1 it was found necessary to replace four rafters in the top section of the dome and also to repair several leaders.

The shops for the carpenters, plumber, and painter are now in the basement of the mansion.

Grounds

On Saturdays, Sundays, and holidays from the last Sunday in May to the first Sunday in September, the Garden was patrolled by five uniformed city officers and two detectives, who very successfully enforced the park ordinances relative to the destruction of shrubbery, scattering of paper, and general vandalism. During this period, about 155 arrests were made, and in each case the offender was fined, the fines being from one to ten dollars. Owing to the assistance of the city officers and the vigilance of our employees, the damage done to the plantations and lawns was very slight. On Sundays and holidays during the summer months, the average number of visitors was about 35,000, and in July and August, the number increased to 45,000.

During the months of February, March, and April, we removed about 1,200 dead trees from the new land and about 50 trees from the hemlock grove. This work was greatly facilitated by the assistance of men from the New

York Association for Improving the Condition of the Poor, who also helped considerably with other work around the grounds during the year.

By running the gasoline engine for about two weeks, we cut sufficient wood to furnish fuel for the propagating houses for five months.

The uprooting of poison ivy has been continued with satisfactory results and will be carried on each spring until it is exterminated.

Guard-rails

About 750 feet of 1-inch guard-rail, two rails high, were erected along the trails in the hemlock grove.

Respectfully submitted,

ARTHUR J. CORBETT,
Superintendent of Buildings and Grounds.

SCHEDULE OF EXPENDITURES DURING THE YEAR 1915

1. CITY MAINTENANCE ACCOUNT

Appropriated		$107,163.00
Expended		
Personal Service		
Salaries	$81,139.83	
Labor	7,309.00	
Total		$88,448.83
Sundry Expenses		
Forage	$ 881.47	
Fuel	11,804.35	
Supplies	1,213.96	
Equipment	1,657.53	
Materials	1,881.98	
Repairs	229.69	
Telephone Service	116.51	
Contingencies	926.62	
Total		$18,712.11
Total Expended		$107,160.94
Balance to be rescinded		2.06

2. CONSTRUCTION AND EQUIPMENT

1911 Account

Erection of an additional Greenhouse.

January 11, 1915, Balance	$ 120.11	
Rescinded, January 16, 1915	120.11	

3. SPECIAL GARDEN ACCOUNTS

EXPLORATION FUND

1901 to 1914. Subscriptions	$37,028.45	
Sales and Refunds	1,669.06	
Total		$ 38,697.51
1901 to 1913. Expended		38,673.46
Balance		$ 24.05

MUSEUM AND HERBARIUM FUND

1901 to 1914. Subscriptions	$11,895.00	
Sales and Refunds	387.89	
Total		$12,282.89
1901 to 1913. Expended		12,263.99
Balance		$ 18.90

PLANT FUND (CONSERVATORY FUND)

1900 to 1914. Subscriptions	$ 9,576.55	
Sales and Refunds	653.16	
1915. Sales	36.00	
Total		$10,265.71
1900 to 1914. Expended	$10,063.53	
1915. Expended	169.01	
Total		$10,232.54
Balance		$ 33.17

SPECIAL BOOK FUND

1899 to 1914. Subscriptions	$31,547.88	
Sales and Refunds	121.48	
Total		$31,669.36
1899 to 1914. Expended	$31,569.71	
1915. Expended	68.46	
Total		$31,638.17
Balance		$ 31.19

CHARLES FINNEY COX MEMORIAL FUND

1912 and 1913. Subscriptions	$ 5,075.00
Expended	5,068.10
Balance	$ 6.90
1916, January 10. Transferred to the principal of the Endowment Fund for Science and Education	6.90

GARDEN EXTENSION AND COMMEMORATION FUND

Established April 15, 1915

1915. Subscriptions		$10,357.00
Expended		
Salaries	$ 3,455.00	
Labor	1,715.00	
Supplies and Materials	1,360.73	
Heating Plant	589.99	
Motor Car	428.95	
Board Room Furnishings	1,046.85	
Plans	599.36	
Anniversary Celebration	708.97	
Contingencies	45.58	
Total		$10,356.43
Balance		.57

SUMMARY OF SPECIAL GARDEN ACCOUNTS

Subscriptions

1899 to 1914	$95,122.88
1915	10,357.00

Sales and Refunds

1899 to 1914	$ 2,831.59
1915	36.00
Total	$108,347.47

Expended

1899 to 1914	$97,638.79
1915	10,600.80
Total	$108,239.59
Balance	$ 107.88

4. SPECIAL INCOME ACCOUNTS

	Appropriated	*Expended*	*Balances*
Income of Science and Education Fund			
Laboratories		$ 440.70	
Lectures and Lantern Slides		367.86	
Photography		380.48	
Purchase of Plants, Specimens, and Books		1,487.46	
Supplies and Contingencies		322.98	
Totals	$ 3,000.00	$ 2,999.48	$ .52
Income of Darius Ogden Mills Fund			
Exploration	2,000.00	1,879.29	120.71
Income of Henry Iden Fund			
Resident Research Scholarships	400.00	250.00	150.00
Income of William R. Sands Fund			
Horticultural Prizes	460.00	452.00	8.00
Income of Caroline and Olivia E. Phelps Stokes Fund			
Preservation of Native Plants	120.00	81.82	38.18
Income of Students Research Fund			
Aid for Students Research	150.00	150.00	——
Income of David Lydig Fund			
Publications	3,000.00	2,989.39	10.61
Accumulated Income of Addison Brown Fund			
Colored Illustrations of Plants	1,700.00	——	1,700.00
Accumulated Income of John Innes Kane Fund			
Plants for Grounds and Greenhouses	600.00	553.00	47.00
Income of Maria DeWitt Jesup Fund			
Purchase of Specimens	225.00	212.50	12.50
Totals	$11,655.00	$ 9,567.48	$ 2,087.52

5. GENERAL INCOME ACCOUNT

	Appropriated, including Transfers	*Expended*	*Balances*
Museums and Herbarium	$ 650.00	$ 600.00	$ 50.00
Publications	650.00	629.57	20.43
Investigations at other Institutions	25.00	25.00	——
Circulars for Membership	140.00	133.07	6.93
Insurance	500.00	490.10	9.90
Supplies (including binding)	1,650.00	1,642.69	7.31
Contingent Fund	880.00	872.33	7.67
Entertainment	760.00	751.95	8.05
Assistance for Treasurer	480.00	480.00	——
Special Assistance	600.00	599.50	.50
Exploration	1,130.00	1,124.01	5.99
Salaries	12,270.00	12,260.00	10.00
Labor	3,365.00	3,361.13	3.87
Totals	$23,100.00	$22,969.35	$ 130.65

6. EXPENDED FROM FUNDS OF THE GARDEN

Special Garden Accounts for 1915	$10,600.80
Special Income Accounts	9,567.48
General Income Account	22,969.35
Total	$43,137.63

Respectfully submitted,
WALTER S. GROESBECK,
Accountant.

E. and O. E.
NEW YORK, January 10, 1916.

SUBSCRIPTIONS TO THE GARDEN EXTENSION AND COMMEMORATION FUND

Mr. Fritz Achelis	$100
Mr. Edward D. Adams	100
Mrs. James Herman Aldrich	20
Mr. Oakes Ames	25
Mr. A. J. C. Anderson	10
Mr. John D. Archbold	250
Mrs. George A. Archer	25
Mr. Edward W. C. Arnold	10

Mrs. E. S. Auchincloss	10
Mrs. Hugh D. Auchincloss	25
Mr. Samuel P. Avery	25
Mr. George F. Baker	100
Mrs. Robert F. Ballantine	10
Mr. George D. Barron	10
Mr. Alfred N. Beadleston	50
Mrs. A. Frederick Behre	5
Mr. Louis V. Bell	25
Mr. E. P. Bicknell	10
Miss Elizabeth Billings	25
Mr. Ernest C. Bliss	50
Mr. George Blumenthal	25
Miss R. C. Boardman	10
Mrs. James L. Breese	10
Mr. Jno. I. D. Bristol	5
Dr. N. L. Britton	500
Mr. Andrew Carnegie	500
Mrs. Andrew Carnegie	100
Mr. W. T. Carrington	5
Miss Jennie R. Cathcart	5
Mr. Frank R. Chambers	10
Dr. Walter F. Chappell	5
Mrs. F. A. Constable	25
Mr. James W. Cromwell	25
Mrs. W. Bayard Cutting	25
Mr. Charles Deering	100
Mr. Cleveland H. Dodge	100
Dr. James Douglas	100
Mr. A. F. Estabrook	100
Mr. Charles S. Fairchild	25
Mr. Samuel W. Fairchild	50
Mr. James B. Ford	500
Mr. Henry W. de Forest	25
Dr. Robert W. de Forest	50
Miss J. K. Fraser	20
The Fred'k Page Contracting Company	10
Mr. Henry C. Frick	500
Professor Wm. J. Gies	10
Mrs. Wm. J. Gies	25

Mr. George J. Gould	100
Miss Susan D. Griffith	10
Mr. Daniel Guggenheim	500
Mrs. Wm. Pierson Hamilton	10
Mr. J. Horace Harding	100
Mr. J. Montgomery Hare	25
Mr. Edward S. Harkness	500
Mrs. Julia Riker Harmon	10
Professor R. A. Harper	10
Mrs. E. H. Harriman	50
Miss Josephine T. Harriot	10
Mr. T. A. Havemeyer	50
Miss Caroline C. Haynes	10
Mr. A. Heckscher	50
Mr. Hancke Hencken	10
Mrs. H. P. Hodson	10
Mr. Richard M. Hoe	10
Mrs. Richard March Hoe	10
Mr. Bernhard Hoffmann	10
Horticultural Society of New York	250
Mr. Theodore R. Hoyt	25
Mr. Adolph G. Hupfel	10
Mrs. D. Willis James	25
Miss Annie B. Jennings	25
Mr. Walter Jennings	25
Mrs. Delancey Kane	100
Mrs. John S. Kennedy	50
Mr. Edward V. Z. Lane	25
Mr. Lewis H. Lapham	100
Professor Frederic S. Lee	25
Mr. M. C. Lefferts	10
Mr. Paul Lichtenstein	5
Mr. A. Lueder	5
Mrs. V. Everit Macy	50
Mrs. Henry Marquand	25
Mr. Louis Marshall	25
Mr. Edgar L. Marston	25
Mr. W. J. Matheson	50
Mr. James McLean	50
Mr. Emerson McMillin	100

Mr. Ogden Mills	100
Mr. J. P. Morgan	200
Dr. Lewis Rutherford Morris	100
Dr. John P. Munn	25
Mr. Frederick R. Newbold	25
Mr. E. E. Olcott	25
Mrs. William C. Osborn	25
Mr. James C. Parish	50
Colonel O. H. Payne	300
Mr. E. S. Pegram	5
Mr. George W. Perkins	200
Mrs. George W. Perkins	100
Mr. William H. Perkins	50
Mr. Charles F. Rand	25
Miss Emily Redmond	25
Mr. Edwin A. Richard	100
Miss Elvine Richard	50
Mr. John J. Riker	100
Mr. William J. Riker	25
Dr. William C. Rives	25
Mr. William Rockefeller	200
Mr. Wm. Emlen Roosevelt	100
Mrs. Wm. Emlen Roosevelt	10
Dr. H. H. Rusby	10
Mrs. Archibald D. Russell	100
Mr. Jacob H. Schiff	100
Mr. Mortimer L. Schiff	100
Miss Grace Scoville	100
Mr. James A. Scrymser	500
Mr. A. R. Shattuck	25
Mrs. Finley J. Shepard	100
Mr. William Shillaber	25
Mrs. Alfred L. Simon	10
Mrs. Benson B. Sloan	25
Mr. William Sloane	25
Mr. Pierre J. Smith	10
Mr. James H. Stebbins	10
Mr. Francis Lynde Stetson	100
Mr. Alexander H. Stevens	10
Miss Ellen J. Stone	10

Mr. Frederick Strauss	20
Mr. F. K. Sturgis	50
Mrs. Henry O. Taylor	100
Mr. Charles G. Thompson	100
Mrs. F. F. Thompson	100
Dr. W. Gilman Thompson	25
Mr. Wm. B. Thompson	10
Mr. Myles Tierney	50
Mr. Louis C. Tiffany	50
Mr. Henry N. Tifft	10
Miss Anna Murray Vail	10
Mr. W. K. Vanderbilt	200
Dr. Henry F. Walker	10
Mr. Felix M. Warburg	100
Mrs. George Cabot Ward	25
Mr. William Young Westervelt	10
Hon. Geo. Peabody Wetmore	50
Dr. Wm. E. Wheelock	10
Mr. Egerton L. Winthrop	25
Anonymous	37
Total	$10,357

REPORT OF THE CHAIRMAN OF THE SCIENTIFIC DIRECTORS

(*Received and ordered printed, January 10, 1916*)

To the Board of Managers of the New York Botanical Garden.

Gentlemen: I have the honor to submit the following report from the Scientific Directors for the year 1915.

The history of the past year is distinguished by the records of a number of events of unusual importance. Among these may be accounted the celebration of the Twentieth Anniversary of the appropriation of land for the Garden by the City of New York. This celebration occurred from the 6th to the 11th of September, inclusive. The exercises of the occasion represented two quite distinct series, the one designed to entertain our guests and to make known to them the history, equipment, and work of the Garden, the other to provide for scientific contributions by the guests themselves. Both portions of the work were admirably designed by Dr. Britton and Dr. Harper, to whom the work was assigned, and were executed in perfect accordance with their plans. One hundred and forty-five persons registered their attendance, representing almost every botanical organization in the country and including many non-professional botanists. The fifty-three scientific papers presented covered every branch of botanical science and included a remarkable variety of subjects. It is doubtful if any botanical meeting ever held in America constituted a more complete exhibit of the character of the botanical work in progress in this country. The successful execution of so large and varied a program within the time allotted, with no appreciable restriction upon discussion, is a feat that will be appreciated by all who have been called upon to preside on similar occasions, and one that reflects great credit upon the Committee in charge. A full report of the meetings was pub-

lished in the October number of the *Journal*, and the publication of most of the contributions, in full, is planned.

The most important event of the year, so far as the Garden's interests are concerned, is the addition to its lands of the new tract recently granted by the city. Plans for the development of this tract will doubtless be fully discussed in the report of the Director-in-Chief, but we desire to refer here to our keen interest in the great and varied possibilities which this addition affords for the extension of our experimental and educational work. We are especially gratified by the possession of the facilities afforded by the Lorillard mansion.

The report on the cultivation of drug and dye plants which we prepared at your request, and which was published in the August number of the *Journal* and reprinted for special circulation, has received and is still receiving a great amount of attention throughout the country. A large number of the reprints have been called for and supplied. The beneficial influence of this timely publication has extended in two quite different directions. It has tended to counteract the misleading effects of certain widely read articles encouraging a belief in the simplicity and ease of securing financial returns from the cultivation of drugs and has thus saved many from unwise investments of time and money, and, on the other hand, has encouraged a number of persons to undertake careful experimental work in certain restricted and promising portions of this field of agriculture.

The publication in the January number of the *Journal*, of our lecture on the influence of radio-active earth on plant growth and crop production has also received great attention, thousands of reprints having been distributed. The records presented in this publication have been variously interpreted. On theoretical grounds, their reference to the action of radium has been denied by some authorities, while the facts themselves have not been otherwise explained. In the meantime, experiments on a large scale have been induced by the publication.

The explorations of the year included further work in Porto Rico by several persons. Dr. and Mrs. Britton, with the late Mr. J. F. Cowell and Mr. Stewardson Brown, spent two months, in February and March, in exploration on that island. The work of Professor N. Wille, of the University of Christiania, in the collection of fresh-water algae, announced in our last report as having been commenced, was completed during the early part of the present year, and yielded very rich scientific results. This work was supplemented by several weeks' work in June and July in the collection of marine algae by Dr. Marshall A. Howe, in the waters surrounding the island.

Several weeks were devoted by Dr. Small to work among the Florida Keys, an exploration that was made possible through the generosity of Mr. Charles Deering. The object of this exploration was peculiar, if not unique. Upon these small islands grow many species of plants which are either very scarce, or do not grow at all in any other locality. As a result of clearing of the land, which is rapidly progressing, such species are doomed to early extinction. Mr. Deering has for some time been engaged in preserving these plants by introducing them to his estate near Miami, and it was to the mutual advantage of both Mr. Deering and the Garden that Dr. Small was able to cooperate in this work.

The usual activity in the acquisition and care of herbarium material has been maintained, more than 36,000 specimens and a corresponding number of herbarium sheets having been added, not including a very large addition to our mycological herbarium. The interest in our work in the study of fungi has again shown a decided increase, there having been an unprecedented call for information on the subject and for the identification of specimens. A large number of new species and genera, representing all classes of plants, have been described during the year.

Our laboratory work has continued to show expansion in activity and interest. The work of Dr. Stout in the

investigation of color variation in *Coleus* has culminated in the publication by the Carnegie Institution of an interesting and handsome volume on this subject. In this work, Dr. Stout has confined himself chiefly to variations developed in budding, but he plans to carry the investigation to the seedlings. A study of the chemical composition of the pigments causing the coloration has been referred to Professor Wm. J. Gies. A study of the pigments in the flowers of tulips is also planned.

Dr. Harper's studies of the genetics of corn have been continued during the past year. Other laboratory investigations have referred to the behavior of sex in *Mercurialis*, a plant in the castor-oil family, self and cross sterility in the flowers of chicory, the effects of hybridity in *Hibiscus*, especially upon the color of the flowers, and the heredity of flower color in *Verbascum Blattaria*. In this plant, the flowers are sometimes yellow and sometimes purple, and there has been much speculation among botanists as to what determines these respective colorations. Other problems investigated refer to *Carex*, *Tulipa*, *Primula*, and cacti. The flora of western Tibet has also received attention.

The enlarged experimental space in the Garden which was last year assigned to the Director of the Laboratories has been fully utilized, and with satisfactory results. He now asks for a similar increase in greenhouse facilities, which it is earnestly hoped we may be able to supply.

All the publications of the Garden have been maintained regularly. While there has been a natural falling off in our European support, owing to the war, there has been a marked increase in that from our own country. There are numerous indications of a healthy increase in scientific work in the South American countries, and it is important that we should maintain and extend close relations with all organized work and with botanical scholars in those countries.

An important event in connection with our publications

is the provision, made at our last meeting, for the early publication of the first number of our new periodical with colored illustrations provided for by the bequest of our late President, Judge Addison Brown.

Thirty-four public lectures have been delivered on Saturday afternoons during the year. No one can scrutinize the subjects included in the list of these lectures without being impressed with their great importance as an educational element in this city. Subjects relating to agriculture and horticulture are: "Flowers for the Spring Garden," "A Rose Garden for Every Home," "Dwarf Fruit Trees for Suburban Homes," "Fungous Diseases of the Flower Garden," "Fighting the Gypsy Moth," "Growing Seeds for the Farm and Garden," and "The Possibilities of Nut Growing in New York." Geographical lectures have treated of Porto Rico, Haïti, the Rocky Mountains, the Austro-Italian Frontier, and the Himalayas. Lectures relating to economic botany have included the following subjects: "The Agriculture of the North American Indians," "Mushrooms for Food," "The Sources of Quinine," "Economic Uses of Seaweeds," and "Correlations between Animals and Plants." The Garden itself has been treated in lectures upon its library and its fossil plant collections.

Public influence of a similar character has been exerted through the flower shows held in cooperation with the Horticultural Society of New York. Of these there have been three, besides one specially provided by Mr. T. A. Havemeyer. These exhibitions were very largely attended.

Our second spring inspection of buildings, grounds, and collections, fully reported in the *Journal* for May, was attended by more than four hundred persons. Our first autumn inspection was held this year and was also largely attended and greatly enjoyed.

The report of Dr. Rose's explorations in western South America, in the August number of the *Journal*, is a noteworthy publication.

Work for the preservation of our native wild flowers has

been continued. Several essays on this subject by pupils of the public schools were published in the *Journal* for June.

The details of all work performed under our direction will be found recorded in the reports of the several members of the staff.

For all information regarding administrative work, which necessarily comes into close relation with our own, you are respectfully referred to the general report of the Director-in-Chief.

Respectfully submitted,

H. H. RUSBY,

Chairman of the Scientific Directors.

REPORT OF THE COMMITTEE ON PATRONS, FELLOWS, AND MEMBERS FOR THE YEAR 1915

To the Board of Managers of the New York Botanical Garden.

Gentlemen: The number of new members who have qualified is 64. The number of Annual Members is now 837; Life Members 149; Sustaining Members 12; Fellowship Members 2.

Of these, 26 are now in arrears for dues for 1915, 9 for dues for 1914 and 1915, and 12 for dues for 1913, 1914, and 1915.

Dues have been collected to the amount of $8,595. Two persons have qualified as Fellows for Life by the payment of $1,000 each, and one as a Life Member by the payment of $250. These sums have been transmitted to the Treasurer.

A complete list of all classes of members to date is herewith submitted.

Benefactors

*Hon. Addison Brown,
Andrew Carnegie,
Columbia University,
*Hon. Chas. P. Daly,
*D. O. Mills,
*J. Pierpont Morgan, Sr.
John D. Rockefeller,
*Cornelius Vanderbilt.

Patrons

Oakes Ames,
*Miss Catherine A. Bliss,
Dr. N. L. Britton,
*Hon. Addison Brown,
Andrew Carnegie,
*Mrs. George Whitfield Collord,
*James M. Constable,
*William E. Dodge,
James B. Ford,
George J. Gould,
Edward S. Harkness,
*Mrs. Esther Herrman,
Archer M. Huntington,
*Henry Iden,
Mrs. John Innes Kane,
*John Stewart Kennedy,
*J. Pierpont Morgan, Sr.
*Oswald Ottendorfer,
*Lowell M. Palmer,
William Rockefeller,
*William R. Sands,
*William C. Schermerhorn,

* Deceased.

James A. Scrymser,
Mrs. Finley J. Shepard,
*Samuel Sloan,
Mrs. Frederic F. Thompson,
W. K. Vanderbilt,
Mrs. Antoinette Eno Wood.

Fellows for Life

Edward D. Adams,
John D. Archbold,
George F. Baker,
Miss Elizabeth Billings,
Mrs. W. Bayard Cutting,
Dr. Robert W. de Forest,
Cleveland H. Dodge,
James B. Ford,
Daniel Guggenheim,
Murry Guggenheim,
S. R. Guggenheim,
Mrs. D. Willis James,
Mrs. John Stewart Kennedy,
Edward V. Z. Lane,
Mrs. Frederic S. Lee,
Hon. Seth Low,
James McLean,
Ogden Mills,
George W. Perkins,
M. F. Plant,
Mortimer L. Schiff,
James A. Scrymser,
Francis Lynde Stetson,
Miss Olivia E. Phelps Stokes
Charles G. Thompson,
Louis C. Tiffany,
Tiffany & Company.

Life Members

Edward D. Adams,
Dr. Felix Adler,
Mrs. James Herman Aldrich,
Constant A. Andrews,
J. Sherlock Andrews,
Dr. S. T. Armstrong,
Edward W. C. Arnold,
Mrs. H. D. Auchincloss,
Samuel P. Avery,
Samuel D. Babcock,
Geo. V. N. Baldwin,
Dr. John Hendley Barnhart,
George D. Barron,
Aurel Batonyi,
Gustav Baumann,
Samuel R. Betts,
William G. Bibb,
Miss Elizabeth Billings,
J. O. Bloss,
George Blumenthal,
George C. Boldt,
G. T. Bonner,
J. Hull Browning,
Joseph Bushnell,
T. Morris Carnegie,
Frank R. Chambers,
Hugh J. Chisholm,
Hugh J. Chisholm, Jr.,
Geo. C. Clark,
Banyer Clarkson,
Dr. James B. Clemens,
Wm. F. Cochran,
William Colgate,
Miss Georgette T. A. Collier,
Mrs. William Combe,
W. E. Connor,
Mrs. F. A. Constable,
Theodore Cooper,

*Deceased.

Zenas Crane,
R. N. Cranford,
Melville C. Day,
Charles Deering,
Mrs. John Ross Delafield,
Miss Julia L. Delafield,
Maturin L. Delafield, Jr.,
W. B. Dickerman,
James Douglas,
Miss Josephine W. Drexel,
Miss Ethel DuBois,
Miss Katharine DuBois,
Wm. A. DuBois,
Geo. E. Dunscombe,
Thomas Dwyer,
Newbold Edgar,
George Ehret,
Ambrose K. Ely,
Amos F. Eno,
Edward J. Farrell,
Mrs. H. J. Fisher,
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Mrs. John French,
Henry C. Frick,
Mrs. Theodore Kane Gibbs,
James J. Goodwin,
Daniel Guggenheim,
Bernard G. Gunther,
Franklin L. Gunther,
Frederic R. Halsey,
Chas. J. Harrah
Dr. Louis Haupt,
R. Somers Hayes,
George B. Hopkins,
Samuel N. Hoyt,
Archer M. Huntington,
Frank D. Hurtt,
James H. Hyde,
Mrs. Columbus O'D. Iselin,
Theo. F. Jackson,
Dr. Walter B. James,
Miss Annie B. Jennings,
Nathaniel T. Kidder,
William M. Kingsland,
H. R. Kunhardt,
W. B. Kunhardt,
Charles Lanier,
W. V. Lawrence,
Meyer H. Lehman,
Mrs. Geo. Lewis,
Joseph Loth,
David Lydig,
Wm. H. Macy, Jr.,
Mrs. Wm. H. Macy, Jr.,
Louis Marshall,
Edgar L. Marston,
William J. Matheson,
C. W. McAlpin,
Guy R. McLane,
Emerson McMillin,
Dr. Geo. N. Miller,
A. G. Mills,
Hon. Levi P. Morton,
Sigmund Neustadt,
A. Lanfear Norrie,
Gordon Norrie,
Geo. M. Olcott,
Mrs. Chas. Tyler Olmstead.
Wm. Church Osborn,
Henry Parish,
Geo. W. Perkins,
W. H. Perkins,
James Tolman Pyle,
M. Taylor Pyne,
Geo. W. Quintard,
John J. Riker,
J. C. Rodgers,
Thomas F. Ryan,
Mrs. Herbert L. Satterlee,

Dr. Reginald H. Sayre,
Edward C. Schaefer,
F. Aug. Schermerhorn,
Jacob H. Schiff,
Mortimer L. Schiff,
Grant B. Schley,
Mrs. I. Blair Scribner,
Isaac N. Seligman,
Geo. Sherman,
James Speyer,
Miss Ellen J. Stone,
Albert Tag,
Paul G. Thebaud,
Charles G. Thompson,
Mrs. Frederick F. Thompson,
Robert M. Thompson,
William Thorne,
Wm. Stewart Todd,
Miss Anna Murray Vail,
F. T. Van Beuren,
Mrs. C. Vanderbilt,
Dr. Henry Freeman Walker,
F. N. Warburg,
John I. Waterbury,
Miss Emily A. Watson,
S. D. Webb,
Dr. W. Seward Webb,
Hon. Geo. Peabody Wetmore,
Mrs. Joseph M. White,
John D. Wing,
Mrs. Anna Woerishoffer.

Fellowship Members

J. P. Morgan,
E. A. Richard.

Sustaining Members

Miss Elizabeth Billings,
Miss Mary T. Bryce,
James Douglas,
Wm. H. Fischer,
John Greenough,
Mrs. McDougall Hawkes,
Mrs. D. Willis James,
O. H. Kahn,
Edgar L. Marston,
George Grant Mason,
Arthur M. Mitchell,
Wm. Church Osborn.

Annual Members

Dr. Robert Abbe,
David T. Abercrombie,
Benjamin Abert,
Fritz Achelis,
Henry S. Adams,
Mrs. Cornelius R. Agnew,
Alexander Alexander,
Douglas Alexander,
Harry Alexander,
Mrs. William Allen,
Ernest J. H. Amy,
A. J. C. Anderson,
J. M. Andreini,
W. H. Andrews,
John D. Archbold,
Mrs. John F. Archbold,
Mrs. George A. Archer,
Francis J. Arend,
Reuben Arkush,
Mrs. H. O. Armour,

Dr. John Aspell,
Miss E. E. Auchincloss,
Mrs. E. S. Auchincloss,
John W. Auchincloss,
Dr. Pearce Bailey,
Charles Baird,
Miss Charlotte S. Baker,
Geo. F. Baker,
Stephen Baker,
Albert H. Baldwin,
Frederick H. Baldwin,
George V. N. Baldwin, Jr.,
H. M. Baldwin,
William D. Baldwin,
Mrs. Robert F. Ballantine,
Miss Catherine M. Banks,
Louis H. Barker,
Wm. M. Barnum,
Clarence W. Barron,
Chas. Baskerville,
Alfred N. Beadleston,
Jeremiah Beall,
John D. Beals,
Mrs. Chas. C. Beaman,
Mrs. Margaret B. Becker,
Gerard Beekman,
Robert Behr,
Mrs. A. Frederick Behre,
Louis V. Bell,
August Belmont,
E. C. Benedict,
James Gordon Bennett,
Miss Mary Benson,
E. R. T. Berggren,
Isaac J. Bernheim,
Mrs. Adolph Bernheimer
Chas. L. Bernheimer,
Philip Berolzheimer,
S. Reading Bertron,
Edward J. Berwind,

G. N. Best,
W. H. Bickelhaupt,
Eugene P. Bicknell,
Mrs. George Biddle,
Mrs. Sylvan Bier,
Abraham Bijur,
Moses Bijur,
C. Edw. Billgvist,
C. K. G. Billings,
W. H. Birchall,
E. D. Bird,
James C. Bishop,
J. Insley Blair,
T. Whitney Blake,
C. N. Bliss, Jr.,
Ernest C. Bliss,
Miss S. D. Bliss,
Mrs. Walter P. Bliss,
Wm. H. Bliss,
Hugo Blumenthal,
Mrs. Albert Barnes Boardman,
Miss R. C. Boardman,
Mrs. Edward C. Bodman,
Kurt A. Boerner,
Henry W. Boettger,
Robert Boettger,
Miss Anna Bogert,
William H. Bolton,
A. Huidekoper Bond,
Mrs. Sydney C. Borg,
Frederick G. Bourne,
Louis Boury,
John M. Bowers,
James B. Brady,
Hon. John J. Brady,
Frank Brainerd,
Mrs. E. N. Breitung,
Adolph Breslauer,
Mrs. Benjamin Brewster,
John R. Brinley,

Jno. I. D. Bristol,
Miss H. Louise Britton,
Richard H. Britton,
Bronx Hay & Grain Co.,
Mrs. Kate M. Brookfield,
Mrs. H. D. Brookman,
Miss Aneita D. Brown,
Dickson Q. Brown,
Edwin H. Brown,
M. Bayard Brown,
Vernon C. Brown,
W. P. Brown,
Mrs. J. Hull Browning,
F. W. Bruggerhoff,
H. B. Brundrett,
Mrs. Lloyd Bryce,
Edwin M. Bulkley,
Dr. L. Duncan Bulkley,
James A. Burden, Jr.,
Edward G. Burgess,
Dr. Edward S. Burgess,
Algernon T. Burr.
Freeman F. Burr,
Chas. W. Burroughs,
Mrs. Wendell L. Bush,
Charles S. Butler,
Miss Emily O. Butler,
Miss Helen C. Butler,
Mrs. P. H. Butler,
Thomas J. Byrne,
H. A. Caesar,
W. R. Callender,
Albert Calman,
Henry L. Calman,
H. H. Cammann,
Henry L. Cammann,
Mrs. John Campbell,
H. W. Cannon,
James G. Cannon,
Mrs. George L. Carnegie,
Mrs. Miles B. Carpenter,
Wm. T. Carrington,
R. A. Carter,
H. T. Cary,
George B. Case,
Miss Jennie R. Cathcart,
Miss Maria Bowen Chapin,
Dr. Walter F. Chappell,
Jose Edwards Chaves,
B. Ogden Chisolm,
Geo. E. Chisolm,
Wm. G. Choate,
Mrs. Helen L. Chubb,
Percy Chubb,
Chas. T. Church,
John Claflin,
George S. Clapp,
Miss Alice L. Clark,
D. Crawford Clark,
Miss Emily Vernon Clark,
F. Ambrose Clark,
Hon. W. A. Clark,
William N. Clark,
E. A. S. Clarke,
George C. Clausen,
Albert Clayburgh,
Wm. P. Clyde,
Miss Mary T. Cockcroft,
Hon. W. Bourke Cockran,
C. A. Coffin,
Edmund Coffin,
E. W. Coggeshall,
William N. Cohen,
Mrs. Rufus Cole,
Mrs. James B. Colgate,
William Colgate,
Robert J. Collier,
Mrs. Minturn Post Collins,
Dr. Stacy Budd Collins,
Samuel P. Colt,

Miss Mary Compton,
T. G. Condon,
Hermann Conheim,
Roland R. Conklin,
J. N. Conyngham,
Arthur N. Cooley,
Marin LeBrun Cooper,
Mrs. Marin LeBrun Cooper,
Frank R. Cordley,
C. R. Corning,
Mrs. Charles Henry Coster,
Geo. F. Crane,
Mrs. Jonathan H. Crane,
Mrs.Agnes Huntington Cravath,
William Crawford,
John D. Crimmins,
Mrs. Thomas Crimmins,
W. T. Crocker,
James W. Cromwell,
Mrs. C. Vanderbilt Cross,
Charles Curie,
Ellicott D. Curtis,
G. Warrington Curtis,
R. Fulton Cutting,
Mrs. Ira Davenport,
J. Clarence Davies,
Julien T. Davies,
Daniel A. Davis,
Miss H. Anna Davis,
Miss Ella H. Davison,
Clarence S. Day,
Henry Dazien,
E. J. de Coppet,
Dr. Robert W. de Forest,
Mrs. Robert W. de Forest,
B. F. DeKlyn,
J. R. Delamar,
Eugene Delano,
John B. Dennis,
Rev. H. M. Denslow,
Walter D. Despard,
Miss Elsie de Wolfe,
Chas. D. Dickey,
Geo. H. Diehl,
A. P. Dienst,
Chas. F. Dieterich,
Miss Josephine H. Dill,
Miss Mary A. Dill,
Miss Gertrude Dodd,
Cleveland H. Dodge,
Francis P. Dodge,
Otto L. Dommerich,
Henry Dorscher,
Mrs. George William Douglas,
Mrs. James Douglas,
Alfred Douglass,
Tracy Dows,
Mrs. Henry Draper,
J. R. Drexel,
Isaac W. Drummond,
Matthew B. Dubois,
Mrs. Matthew B. Dubois,
Mrs. John P. Duncan,
Ralph Wurts Dundas,
Dr. Carroll Dunham,
Dr. Edward K. Dunham,
Mrs. Geo. H. Dunham,
John E. Dwight,
Mrs. Frederick H. Eaton,
D. Edgar,
Thomas C. Edmonds,
Mrs. J. S. Ehrich,
Karl Eilers,
Henry G. Eilshemius,
August Eimer,
William Einstein,
Wm. D. Ellis,
Miss L. F. Emmett,
Robert Temple Emmett,
Mrs. Arthur B. Emmons,

Jno. C. Eno,
Miss Mary Pinchot Eno,
R. Erbsloh,
Henry Esberg
Arthur F. Estabrook,
Louis Ettlinger,
A. W. Evarts,
Chas. S. Fairchild,
Samuel W. Fairchild,
William L. Feeney,
Walton Ferguson,
Pliny Fisk,
Harry Harkness Flagler,
Joseph A. Flannery,
Isaac D. Fletcher,
Miss Helena Flint,
Edward H. Floyd-Jones,
Franz Fohr,
James D. Foot,
L. G. Forbes,
Scott Foster,
Mrs. M. J. Fox,
R. A. Franks,
Miss Jane K. Fraser,
Miss S. Grace Fraser,
Dr. J. J. Friedrich,
A. S. Frissell,
John W. Frothingham,
E. A. Funke,
Miss Clementina Furniss,
Albert Gallatin,
Geo. F. Gantz,
Francis P. Garvin,
Joseph E. Gay,
Mrs. Walter Geer,
John J. Gibbons,
R. W. Gibson,
J. Waldron Gillespie,
Mrs. S. D. Godfrey,
W. S. Gordon,
Paul Gottheil,
Chas. Gotthelf,
Chas. A. Gould,
Edwin Gould,
G. C. Graves,
Nelson Z. Graves,
Hon. John Clinton Gray,
Miss Eliza R. Greenwood,
Rev. David H. Greer,
Miss Margarette E. Griffith,
Miss Susan D. Griffith,
E. Morgan Grinnell,
Henry W. Guernsey,
A. M. Guinzburg,
Miss Delia L. Gurnee,
W. S. Gurnee,
Mrs. Gurnee,
Miss Edith Haas,
John A. Hadden, Jr.,
Daniel S. Hage,
William Hague,
Hon. Ernest Hall,
Wm. Halls, Jr.,
Wm. Hamann,
L. Gordon Hamersley,
Miss Adelaide Hamilton,
Miss Elizabeth S. Hamilton,
Mrs. William P. Hamilton,
William F. Hammond,
Ferdinand Hansen,
Anson W. Hard,
J. Montgomery Hare,
Mrs. Charles W. Harkness,
E. S. Harkness,
Mrs. Frank D. Harmon,
Harry Harper,
S. W. Harriot,
William Hamilton Harris.
Jacob Hasslacher,
T. A. Havemeyer,

J. Woodward Haven,
Matthew Hawe,
Miss Caroline C. Haynes,
Mrs. W. R. Hearst,
Wm. W. Heaton,
Hancke Hencken,
Chas. Henderson,
Mrs.E. C. Henderson,
Harmon W. Hendricks,
Mrs. A. Barton Hepburn
B. F. Hermann,
Ferdinand Hermann,
Selmar Hess,
H. H. Hewitt,
Mrs. James J. Higginson,
Walter Hinchman,
Mrs. Samuel N. Hinckley,
J. Oakley Hobby,
B. Hochschild,
Mrs. H. P. Hodson,
Richard M. Hoe,
Mrs. Richard March Hoe,
Mrs. Robert Hoe,
Bernhard Hoffmann,
Mrs. Edward Holbrook,
John Swift Holbrook,
Henry Holt,
Hoole & Geiswein,
F. T. Hopkins,
William B. Hornblower,
Frederick B. House,
C. J. Housman,
M. D. Howell,
Mrs. Henry Howland,
John Sherman Hoyt,
Theodore R. Hoyt,
Walter C. Hubbard,
Conrad Hubert,
Mrs. E. W. Humphreys,
Mrs. C. P. Huntington,

Adolph G. Hupfel,
Frank DeK. Huyler,
Mrs. Clarence M. Hyde,
Henry St. John Hyde,
Dr. Edward J. Ill,
Adrian Iselin, Jr.,
C. Oliver Iselin,
Miss Georgine Iselin,
William E. Iselin,
Mrs. William E. Iselin,
Miss Flora E. Isham,
Samuel Isham,
Dr. Abram Jacobi,
Samuel K. Jacobs,
John S. Jacobus,
A. C. James,
Mrs. Arthur Curtis James,
Dr. Robert C. James,
E. C. Jameson,
Alfred W. Jenkins,
O. G. Jennings,
Walter B. Jennings,
Mrs. Townsend Jones,
Karl Jungbluth,
Henry M. Kahle,
Louis Kahn,
Mrs. Delancey Kane,
Miss Louise Landgon Kane,
Wilhelm Kaupe,
Mrs. H. F. Kean,
Frank Browne Keech,
Henry F. Keil,
Prof. J. F. Kemp,
Mrs. John S. Kennedy,
Mrs.H.Van Rensselaer Kennedy,
David Keppel,
Rudolph Keppler,
Mrs. Catherine L. Kernochan,
John B. Kerr,
Geo. A. Kessler,

Patrick Kiernan,
S. E. Kilner,
Alfred R. Kimball,
David H. King, Jr.,
Mrs. Wm. M. Kingsland,
Darwin P. Kingsley,
Morris Kinney,
W. Ruloff Kip,
E. C. Klipstein,
Roland F. Knoedler,
Chas. Kohlman,
H. C. Kudlick,
Adolf Kuttroff,
Francis G. Landon,
Edward V. Z. Lane,
Woodbury Langdon,
Mrs. Jacob Langeloth,
Dr. G. Langmann,
Mrs. John J. Lapham,
Lewis H. Lapham,
F. F. Lathrop,
Countess de Laugier-Villars,
Mrs. Lauterbach,
John Burling Lawrence,
Prof. Frederic S. Lee,
Marshall C. Lefferts,
Wm. H. Lefferts,
James M. Lehmaier,
Wm. H. Leupp,
Edmund J. Levine,
Emanuel Levy,
Adolph Lewisohn,
Miss Alice Lewisohn,
Julius A. Lewisohn,
Philip Lewisohn,
Paul Lichtenstein,
Lowell Lincoln,
Frederick J. Lisman,
Lucius N. Littauer,
Mrs. John R. Livermore,
Wm. S. Livingston,
Wm. C. Lobenstine,
Frank J. Logan,
Mrs. Geo. de Forest Lord,
Lord & Burnham Co.,
P. Lorillard, Jr.,
Ethelbert I. Low,
Miss Carlotta R. Lowell,
August Lueder,
Walther Luttgen,
Clarence H. Mackay,
Kenneth K. Mackenzie,
Malcolm MacMartin,
George H. Macy,
V. Everit Macy,
F. Robert Mager,
J. H. Maghee,
Pierre Mali,
Chas. Mallory,
J. A. Manda,
Miss Delia W. Marble,
John Markle,
Dr. J. W. Markoe,
Mrs. Henry Marquand,
Prof. W. C. Marquette,
C. P. Marsh,
Edwin S. Marston,
George Massey,
William J. Matheson,
Robert Maxwell,
Harry Mayer,
Effingham Maynard,
Dr. D. H. McAlpin,
Geo. L. McAlpin,
Rev. Thomas J. McCluskey,
John G. McCullough,
Henry P. McKenney,
John A. McKim,
James McLean,
Edward F. McManus,

B. Frank Mebane,
Herman W. Merkel,
Manton B. Metcalfe,
Herman A. Metz,
Edwin O. Meyer,
Eugene Meyer, Jr.,
George A. Meyer,
Harry J. Meyer,
John G. Milburn,
Geo. M. Miller,
Dr. Adelaide Mills,
Mrs. John Murray Mitchell,
Alphonse Montant,
Barrington Moore,
Clement Moore,
Mrs. Clement C. Moore,
J. C. Moore,
Miss Anne Morgan,
Miss C. L. Morgan,
E. D. Morgan,
Mrs. J. P. Morgan,
Wm. Fellows Morgan,
W. Forbes Morgan, Jr.,
Mrs. Cora Morris,
Mrs. Dave Hennen Morris,
Henry Lewis Morris,
Dr. Lewis R. Morris,
Richard Mortimer,
Henry C. Mott,
Frank J. Muhlfeld,
Carl Muller,
John P. Munn,
Frank A. Munsey,
William S. Myers,
A. G. Nesbit,
Mrs. Russell H. Nevins,
Miss Catherine A. Newbold,
Miss Edith Newbold,
Frederic R. Newbold,
Mrs. William G. Nichols,
Wm. Nilsson,
George Notman,
Adolph S. Ochs,
John Offerman,
P. M. Ohmeis,
E. E. Olcott,
Elam Ward Olney,
Robert Olyphant,
R. M. Olyphant,
Mrs. Emerson Opdycke,
Wm. S. Opdyke,
Mrs. Wm. Openhym,
William C. Orr,
Mrs. William Church Osborn,
Prof. Henry F. Osborne,
Jos. Osler,
Fred'k Page Co.,
Augustus G. Paine,
Henry Parish, Jr.,
Junius Parker,
Winthrop Parker,
James C. Parrish,
Chas. W. Parsons,
Miss Gertrude Parsons,
R. W. Paterson,
W. A. Paton,
O. H. Payne,
Mrs. Frederick Pearson,
Mrs. Wheeler H. Peckham,
Edward S. Pegram,
Mrs. Sarah G. T. Pell,
Edmund Penfold,
Samuel T. Peters,
W. R. Peters,
Mrs. von R. Phelps,
Mrs. William Walter Phelps,
Henry Phipps,
Lloyd Phoenix,
Phillips Phoenix,
Carl Pickhardt,

Gottfried Piel,
Michael Piel,
Henry Clay Pierce,
Winslow S. Pierce,
Mrs. R. Stuyvesant Pierrepont,
J. Fred Pierson,
Mrs. Frank H. Platt,
Albert Plaut,
Gilbert M. Plympton,
Chas. Lane Poor,
Alexander J. Porter,
Abram S. Post,
Miss Blanche Potter,
Frederick Potter,
Mrs. Herbert Lee Pratt,
John T. Pratt,
Miss Cornelia Prime,
Chas. Pryer,
Mrs. Kate Davis Pulitzer,
J. Harsen Purdy,
H. St. Clair Putnam,
Miss Eva C. Putney,
Percy R. Pyne,
Charles F. Quincy,
Dr. Edward Quintard,
Charles Raht,
Edmund D. Randolph,
G. B. Raymond,
Wm. A. Read,
Miss Emily Redmond,
Geraldyn Redmond,
John Reid,
Geo. N. Reinhardt,
Chas. Remsen,
Miss Serena Rhinelander
Miss Elvine Richard,
Eben Richards,
Wm. J. Riker,
George L. Rives,
Dr. Wm. C. Rives,
Geo. I. Roberts,
Miss Mary M. Roberts,
Miss Jennette Robertson,
Andrew J. Robinson,
J. K. Robinson,
William G. Rockefeller,
Alfred Roelker,
Edward L. Rogers,
Miss Harriette Rogers,
Hubert E. Rogers,
A. J. Rolle,
W. Emlen Roosevelt,
Mrs. W. Emlen Roosevelt,
Hon. Elihu Root,
Jacob Rossbach,
C. H. Ruddock,
Carman R. Runyon,
Jacob Ruppert,
Mrs. A. D. Russell,
John Barry Ryan,
Arthur Ryle,
Harry Sachs,
Clarence Sackett,
Mrs. Russell Sage,
Daniel C. Sands,
Miss G. W. Sargent,
Herbert L. Satterlee,
Mrs. Herbert L. Satterlee,
John Scheepers,
Carl Schefer,
Mrs. H. M. Schieffelin,
Dr. Wm. J. Schieffelin,
Rudolph E. Schirmer,
Miss Jane E. Schmelzel,
D. Schnakenberg,
Henrich Schniewind, Jr.,
C. M. Schwab,
Gustav Schwab, Jr.,
Robert J. F. Schwarzenbach,
Walter Scott,

Miss Grace Scoville,
Robert Scoville,
Edward M. Scudder,
Alonzo B. See,
Charles E. Seitz,
Prof. Edwin R. A. Seligman,
Jefferson Seligman,
E. W. Sells,
Mrs. Charles H. Senff,
Alfred Seton,
George R. Sheldon,
Finley J. Shepard,
Wm. Shillaber,
Alfred L. Simon,
John W. Simpson,
Charles A. Singer,
Dr. Frank D. Skeel,
Francis Louis Slade,
Benson B. Sloan,
Samuel Sloan,
Thomas Smidt,
Daniel Smiley,
Dr. A. Alexander Smith,
Miss Fanny A. Smith,
Frank Morse Smith,
F. M. Smith,
Pierre J. Smith,
R. A. C. Smith,
E. G. Snow,
Mrs. Charlotte Sorchan,
Mrs. Edward W. Sparrow,
Mrs. Gino C. Speranza,
W. M. Sperry,
J. R. Stanton,
James H. Stebbins,
James R. Steers,
Chas. H. Steinway,
Fred. T. Steinway,
Wm. R. Steinway,
Olin J. Stephens,
Roderick Stephens,
Benjamin Stern,
Sereno Stetson,
Alexander H. Stevens,
Frederic W. Stevens,
Dr. Geo. T. Stevens,
Mrs. John Wood Stewart,
Lispenard Stewart,
Wm. R. Stewart,
Chauncey Stillman,
Miss Clara F. Stillman,
Dr. D. M. Stimson,
James Stokes,
H. Grant Straus,
Albert Strauss,
Chas. Strauss,
Frederick Strauss,
Martin Strauss,
Samuel Strauss,
Mrs. Gustav Stromberg,
Benj. Strong, Jr.,
John R. Strong,
Joseph Stroock,
F. K. Sturgis,
Mrs. F. K. Sturgis,
Mrs. James Sullivan,
Miss Mary Taber,
Henry W. Taft,
Edward N. Tailer,
James Talcott,
E. H. T. Talmage,
Leon Tanenbaum,
C. A. Tatum,
Henry R. Taylor,
W. A. Taylor,
C. H. Tenney,
H. L. Terrell,
Thomas Thacher,
Miss M. J. Thayer,
Seth E. Thomas, Jr.,

L. S. Thompson,
William B. Thompson,
Dr. W. Gilman Thompson,
Jonathan Thorne,
Samuel Thorne, Jr.,
W. V. S. Thorne,
Myles Tierney,
Louis C. Tiffany,
Henry N. Tifft,
H. M. Tilford,
James Timpson,
J. Kennedy Tod,
P. S. Trainor,
A. F. Troescher,
Frederick K. Trowbridge,
Carll Tucker,
Dr. Alfred Tuckerman,
Paul Tuckerman,
Geo. E. Turnure,
Benjamin Tuska,
Mrs. Mary A. Tuttle,
E. S. Twining,
Mrs. Eliza L. D. Tysen,
Oswald W. Uhl,
Theodore N. Vail,
James J. Van Alen,
Alfred G. Vanderbilt,
D. B. Van Emburgh,
Barend Van Gerbig,
E. H. Van Ingen,
Edgar B. Van Winkle,
Hon. Robert A. Van Wyck,
Mrs. James M. Varnum,
Richard C. Veit,
Thos. F. Vietor,
Frank Vincent,
James N. Wallace,
Wm. I. Walter,
Artemus Ward,
Chas. Willis Ward,
Mrs. John I. Waterbury,
C. W. Watson,
Thomas L. Watt,
Mrs. E. H. Weatherbee,
J. G. Webb,
Mrs. W. Seward Webb,
Miss Alice D. Weekes,
Chas. Wehrhane,
Charles H. Weigle,
Mrs. C. Gouveneur Weir,
Mrs. Samuel W. Weiss,
Mrs. John Wells,
Arthur L. Wessell,
Mrs. Robert E. Westcott,
William Young Westervelt,
Mrs. Alice T. Wheelock,
Dr. Wm. E. Wheelock,
Miss Caroline White,
Horace White,
Clarence Whitman,
Miss Margaret S. Whitney,
Edward A. Wickes,
Elmore A. Willets,
Mrs. I. T. Williams,
Mrs. Percy H. Williams,
Richard H. Williams,
William H. Williams,
W. P. Willis,
Charles T. Wills,
Frank D. Wilsey,
Prof. Edmund B. Wilson,
Mrs. H. S. Wilson,
Miss Margaret B. Wilson,
Bronson Winthrop,
Egerton Winthrop,
Grenville L. Winthrop,
Mrs. Robt. Winthrop,
Mrs. Frank S. Witherbee,
Dr. R. A. Witthaus,
Ernst G. W. Woerz,

Emil Wolff,
Lewis S. Wolff,
William E. Wolff,
Mrs. Cynthia A. Wood,
Prof. R. S. Woodward,
Mrs. William Woodward, Sr.,
P. B. Worrall,
Miss Julia Wray,
Mrs. J. Hood Wright,
Mrs. A. Murray Young,
Edw. L. Young,
Andrew C. Zabriskie,
Mrs. Anna M. von Zedlitz,
Charles H. Zehnder,
August Zinsser,
Charles Zoller,
O. F. Zollikoffer.

Members of the Women's Auxiliary

Mrs. Robert Bacon,
Mrs. Thomas H. Barber,
Miss Elizabeth Billings,
Miss Eleanor Blodgett,
Mrs. James L. Breese,
Mrs. Delancey Kane,
Mrs. A. A. Low,
Mrs. V. Everit Macy,
Mrs. Henry Marquand,
Mrs. George W. Perkins,
Miss Harriette Rogers,
Mrs. James Roosevelt,
Mrs. Archibald D. Russell,
Mrs. Benson B. Sloan,
Mrs. Henry O. Taylor,
Mrs. George Cabot Ward.

Honorary Members of the Women's Auxiliary

Mrs. E. Henry Harriman,
Mrs. John I. Kane,
Miss Olivia E. P. Stokes,
Mrs. F. K. Sturgis,
Mrs. F. F. Thompson.

REPORT OF THE TREASURER

NEW YORK, January 8, 1916

TO THE BOARD OF MANAGERS OF THE NEW YORK BOTANICAL GARDEN.

Gentlemen: Herewith I submit a statement of my receipts and disbursements during the year 1915, and balance sheet from my ledger as of December 31, 1915.

Respectfully yours,
JAMES A. SCRYMSER,
Treasurer.

RECEIPTS AND DISBURSEMENTS

Receipts

Balance as per last Annual Report		$ 34,074.06
Contributions of the City toward Development and Maintenance	$ 99,715.59	
Legacy, Maria DeWitt Jesup, 55% of amount	13,750.00	
Legacy, Jacob Langeloth, to be credited to Endowment Fund for Science and Education	1,000.00	
Charles Budd Robinson Memorial Fund, Contributions	118.00	
Garden Extension and Commemoration Fund, Contributions	10,357.00	
Investment of Addison Brown Legacy, Sale of $22,000 Canadian Pacific Railway Equipment Notes	21,273.34	
Investment of D. O. Mills Fund, Sale of $53,000 Grand Trunk Rwy. Equipment Notes	50,097.30	
Life Fellowship Fees:		
Murry Guggenheim $1,000.00		
S. R. Guggenheim 1,000.00		
to be credited to Endowment Fund for Science and Education	2,000.00	
Annual Dues	8,050.00	

Life Membership Fees		250.00
Fellowship Members' Fees		200.00
Sustaining Members' Fees		275.00
Subscriptions to "*North American Flora*," Sales of Publications, etc., credited to Income of David Lydig Fund		2,402.53
Plant Fund		36.00
Contributions, etc., to Students Research Fund		154.00
Refunds, credited to Income of Stokes Fund		13.64
Sales of Ashes		70.00
Sale of Teas at Mansion		26.60
General Income Account, amount overcredited D. O. Mills Fund in 1914		150.00
Income from Investment of John Innes Kane Fund, Interest 6%, $10,000 New York City Notes		600.00
Income from Investment of Maria De Witt Jesup Fund, $15,000 Northern Pacific Prior Lien Bonds		211.00
Income from Investment of Addison Brown Fund:		
$22,000 Canadian Pacific	$704.75	
$22,000 Northern Pacific	105.12	809.87
Income from General Investments:		
Credited to General Income Account:		
5% on $50,000 Southern Rwy. 1st Consolidated Mortgage Bonds	$2,500.00	
4½% on $50,000 Ches. & Ohio R. R. Co. General Mortgage Bonds	2,250.00	
4% on $50,000 Erie R. R. Co. Prior Lien Bonds	2,000.00	
4% on $59,000 Erie R. R. Co. Penn.-Coll. Trust Bonds	2,360.00	

4% on $50,000 Reading R. R. Co. Jersey Central Coll. Trust Bonds.....	2,000.00		
4% on $24,000 Northern Pacific R. R. St. Paul & Duluth Div.....	960.00		
4% on $30,000 Northern Pacific R. R. Gt. Nor.-C. B. & Q. Coll. Trust Bonds	1,200.00		
4% on $10,000 New York City Stock, due 1959.....	400.00		
5% on $10,000 Louisville & Nashville R. R. Equipment Notes.....	500.00		
4½% on $10,000 N. Y. Central Lines Equipment Notes.....	450.00		
4% on $11,000 Milwaukee, Sparta & N. W. R. R. Bonds.....	440.00		
4½% on $53,000 Grand Trunk Rwy. Equipment Notes, 1 yr. 6 days.....	2,431.38		
4½% on $50,000 Pennsylvania R. R. General Mtge. Bonds, 12 days....	81.25		
6% on $50,000 New York City Notes.....	3,000.00	$ 20,572.63	
Interest at 3% on balances with J. P. Morgan & Co., year 1915.....		636.04	
Total Receipts.....			$232,768.54

Disbursements

Investment of Addison Brown Fund, $22,000 Canadian Pacific Rwy. Equipment Notes, 4½%.....	$ 20,890.53	
Investment of Addison Brown Fund (in place of above which were sold), $22,000 Northern Pacific Rwy. Prior Lien Bonds, 4%.....	20,680.00	

Investment of Maria DeWitt Jesup Fund, $15,000 Northern Pacific Rwy. Prior Lien Bonds, 4%.....	13,378.75	
Investment of D. O. Mills Fund (in place of Grand Trunk Equipments), $50,000 Pennsylvania R. R. Gen'l Mtge. Bonds, 4½%.....	50,500.00	
Income from Investment of Addison Brown Fund, Commission on purchase of $22,000 Northern Pacific Bonds.....	27.50	
Commission paid on purchase, $50,000 Penn. R. R. Bonds, charged to General Income.....	62.50	
Income of D. O. Mills Fund, amount overcredited that Fund in 1914 and now turned back to General Income..	150.00	
Expenses paid through Director-in-Chief:		
Account of City Appropriations.....	99,715.59	
General Accounts for Vouchers Paid	25,028.61	
Special Book Fund for Books.. ...	739.43	
Plant Fund for Purchase of Plants...	277.86	
Garden Extension and Commemoration Fund.	8,666.04	
Income of David Lydig Fund for Publications.	2,358.87	
Income of D. O. Mills Fund for Sundries.....	1,879.29	
Income of Stokes Fund for Printing.	71.56	
Income of Science and Education Fund..	3,370.99	
Income of Henry Iden Fund.....	300.00	
Income of William R. Sands Fund...	383.00	
Income of Students Research Fund..	250.00	
Income of John Innes Kane Fund....	553.00	
Income of Maria DeWitt Jesup Fund	100.00	
Total Disbursements....	$249,383.52	
Balance, Cash in hands of Treasurer (on deposit with J.P. Morgan & Co.)	17,459.08	
	$266,842.60	$266,842.60

Ledger Balances, December 31, 1915

Credit

Permanent Funds

Endowment Fund.		$304,510.00
Endowment Fund for Science and Education		78,455.00
David Lydig Fund, Bequest of Charles P. Daly		34,149.86
Legacy of William R. Sands		10,000.00
Darius Ogden Mills Fund		50,000.00
Henry Iden Legacy		10,000.00
Addison Brown Legacy		21,850.00
John Innes Kane Fund		10,000.00
Stokes Fund		3,000.00
Charles Budd Robinson Memorial Fund		652.30
Students Research Fund		3,621.00
Maria DeWitt Jesup Legacy		13,750.00
		$539,988.16

Temporary Funds

Income of Stokes Fund	$ 132.91	
Income from Investment of Addison Brown Fund	1,832.37	
Life Membership Dues	500.00	
Exploration Fund	24.05	
Charles Finney Cox Memorial Fund	6.90	
Special Fund for Books	77.57	
Plant Fund	165.92	
Garden Extension and Commemoration Fund	1,690.96	
Income from Investment of Maria DeWitt Jesup Fund	111.00	
Income of Students Research Fund	43.32	
Income from Charles Budd Robinson Memorial Fund	19.18	$544,592.34

		Debit
General Investments		
$50,000 Ches. & Ohio Gen'l Mtge. Bonds		
50,000 So. Ry. Co. 1st Cons. Mtge. Bonds		
50,000 Erie R. R. Co. Prior Lien Bonds		
59,000 Erie R. R. Co. Penn.-Coll. Tr. Bonds		$312,424.18
50,000 Reading R. R. Co. J. C. Coll. Tr. Bonds		
24,000 Nor. Pac. R. R.-St. P. & D. Div. Bonds		
30,000 Nor. Pac. Gt. Nor.-C. B. & Q. Coll. Tr. Bonds		
10,000 N. Y. City, 4% Stock, 1959		
Investment, D. O. Mills Fund,		
$50,000 Penn. R. R. Gen'l Mtge. Bonds, 4½%		50,418.33
Investment, Science and Education Fund,		
$10,000 N. Y. Central Lines Equipment	$ 9,510.48	
10,000 Louisville & Nashville Equipment.	10,000.00	
50,000 N. Y. City Notes, due Sept. 1, 1917, 6%.	51,281.25	70,791.73
Investment, Henry Iden Fund,		
$11,000 Milwaukee, Sparta & N. W. R. R. Bonds		10,120.00
Investment, Addison Brown Legacy,		
$22,000 Nor. Pac. Prior Lien Bonds, 4%		21,380.69
Investment, John Innes Kane Fund,		
$10,000 N. Y. City Notes, due Sept. 1, 1917, 6%		10,256.25
Investment, Maria DeWitt Jesup Fund,		
$15,000 Nor. Pac. Prior Lien Bonds, 4%		13,378.75
		$488,769.93

Income of David Lydig Fund, balance borrowed from Permanent Fund...	216.33	
Income of D. O. Mills Fund.....	420.38	
Income from Investment of John Innes Kane Fund...	57.87	
Director-in-Chief, Working Fund.....	25,000.00	
Museum and Herbarium Fund... ...	26.92	
General Income Account, balance borrowed from Permanent Funds.....	12,641.83	
Cash in hands of Treasurer, Jan. 1, 1916 (on deposit with J P. Morgan & Co.).	17,459.08	
	$544,592.34	$544,592.34

REPORT OF THE SPECIAL AUDITOR

Treasurer's Account for the Year 1915

Room 3111, Grand Central Terminal
New York, February 17, 1916

Mr. Edward D. Adams,
Chairman, Finance Committee, New York Botanical Garden,
71 Broadway, New York, N. Y.

Dear Sir:

This is to certify that I have, by direction of the Board of Managers, examined the books and accounts of the Treasurer of the New York Botanical Garden, for the year nineteen hundred and fifteen (1915), together with their proper vouchers, and that I find the balance sheet and the Treasurer's statement of receipts and disbursements attached hereto to be correct.

I have also examined the various investment securities and find the same to be as reported in the said balance sheet.

Respectfully submitted,
A. W. Stone,
Special Auditor.

Director-in-Chief's Account for the Year 1915

Room 3111, Grand Central Terminal
New York, February 17, 1916

Mr. Edward D. Adams,
Chairman, Finance Committee, New York Botanical Garden,
71 Broadway, New York, N. Y.

Dear Sir:

This is to certify that I have examined and audited the financial books and accounts of the Director-in-Chief of the New York Botanical Garden for the year nineteen hundred and fifteen (1915), and that I find the same to be correct, and the cash balance to be as stated in the current cash book.

In accordance with recent practice, I have not included in this auditing the examination of the vouchers for City maintenance or construction work paid for by the City, as such vouchers have been found proper and in order by the City authorities, and it was decided in 1904 by the Chairman of the Finance Committee that a further examination of them was unnecessary. By like authority I have omitted also a detailed examination of the annual membership dues account. These dues are received by the Director-in-Chief and forwarded by him to the Treasurer, the former keeping a detailed record of the same.

Respectfully submitted,
A. W. Stone,
Special Auditor.

VOL. 9 NO. 34

BULLETIN

OF

THE NEW YORK BOTANICAL GARDEN

[ISSUED SEPTEMBER 21, 1916]

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BULLETIN
OF
The New York Botanical Garden

Vol. 9 No. 34

DESCRIPTIVE GUIDE TO THE GROUNDS, BUILDINGS AND COLLECTIONS

Third Edition*

Location

The New York Botanical Garden is situated in the northern part of Bronx Park, north of Pelham Avenue, the reservation including nearly 400 acres of land of a very diversified character, furnishing natural landscapes of great beauty and variety.

Means of Access

The Garden is conveniently reached in the following ways:

1. By the Harlem Division of the New York Central and Hudson River Railroad to The Botanical Garden Station.

2. By the Third Avenue Elevated Railway system to the terminal station of that road at Bronx Park.

3. By the Subway, Lenox Avenue and West Farms branch, with transfer at 149th Street and Third Avenue to Elevated Railway, thence to Bronx Park Station.

4. By trolley car on Webster Avenue to 200th Street or the Woodlawn Road. This line connects with lines from the western part of The Bronx on Fordham Road, and on Tremont Avenue, and also with the line to Yonkers.

5. By trolley car on the White Plains road east of Bronx Park from West Farms, Williamsbridge, and Mt. Vernon, connecting with lines from the eastern part of The Bronx at West Farms and at Mt. Vernon.

* For first edition see Bulletin no. 16: for second edition see Bulletin no. 23.

6. By trolley car, on the Southern Boulevard to Pelham Avenue. This line connects with lines from the southern and southeastern parts of The Bronx.

7. By driveways in Mosholu Parkway from Van Cortlandt Park; from Pelham Bay Park through Pelham Parkway; through the Crotona Parkway and Southern Boulevard from Crotona Park; there are also driveway entrances at 200th Street, convenient for carriages coming from Jerome Avenue; at Newell Avenue, at the northern end of the Garden, for carriages coming from the north; at Allerton Avenue on the eastern side of the Garden for carriages coming from the east; and at the Woodlawn Road, convenient for carriages coming from Yonkers, and from other points west and northwest of the Garden; there are three driveway entrances from Pelham Avenue.

8. The White Plains Avenue Extension of the Subway, with three stations east of the Garden is approaching completion.

Purposes

The New York Botanical Garden was established by an Act of the Legislature of the State of New York passed in 1891 and amended in 1894 "for the purpose of establishing and maintaining a Botanical Garden and Museum and Arboretum therein, for the collection and culture of plants, flowers, shrubs and trees, the advancement of botanical science and knowledge, and the prosecution of original researches therein and in kindred subjects, for affording instruction in the same, for the prosecution and exhibition of ornamental and decorative horticulture and gardening, and for the entertainment, recreation and instruction of the people."

General Plan

Features of especial interest are:

1. The largest conservatories in America, for the cultivation of plants of tropical regions, one located near the entrance at the elevated railway station, and a second very

NEW YORK CENTRAL RAILROAD STATION

large range, partly constructed, near the Allerton Avenue entrance on the eastern side of the Garden.

2. The largest botanical museum in the world, located near the Botanical Garden station of the New York Central Railroad and the Mosholu Parkway entrance. This building includes a large lecture hall for public lectures in the basement; and the library, laboratories for instruction and research, and the herbarium, on the upper floor.

3. The pinetum, or collection of cone-bearing trees, mostly evergreens, brought together on the hills and slopes on all sides of the conservatories, range 1, and in the space between that structure and the museum building.

4. The herbaceous garden, situated in a valley east of the conservatories, range 1, near the Southern Boulevard entrance, containing collections of hardy herbaceous plants, arranged by botanical relationship, and also a collection of similar plants, arranged to demonstrate elementary botany; the economic garden, a plantation designed to illustrate hardy plants whose products are directly useful to man, is installed in the northern part of the same valley.

5. The fruticetum, or collection of hardy shrubs, located on the plain northeast of the museum building at the Woodlawn Road entrance and extending northward into the north meadows; this collection is also arranged by botanical relationship.

6. The deciduous arboretum, or collection of trees which lose their leaves in the autumn, located along nearly the entire eastern side of the grounds from Pelham Avenue to Williamsbridge.

7. Extensive flower gardens at conservatory range 1, along the path approach to this range from the Third Avenue Elevated Railway Station, and along the west border north to the Mosholu Parkway. The total length of flower beds is over one mile.

8. The mansion, a stone house, built by the Lorillard family in 1856, stands on the east side of the Bronx River, above the waterfall. It contains meeting rooms, board

rooms, horticultural laboratories, the collections of the Bronx Society of Arts and Sciences, the office of the Secretary of the Horticultural Society of New York, and the shops of the Garden are in its basement.

9. Special collections of hardy plants in various parts of the grounds, including willows in the north meadows, Japanese cherries and a magnolia group in the arboretum, forest herbaceous plants on the wooded bank north of the long bridge east of the Bronx River; vines and climbers on an arbor east of the economic garden, an iris garden at Pelham Avenue and the Southern Boulevard; lilacs near the museum building and at the foot of the Bronx Boulevard retaining wall, and conifer groups and rhododendrons at various points and other special collections at other places. A large rose garden is being constructed in a valley south of the mansion.

In addition to these artificial features, the following natural features are noteworthy:

10. The hemlock forest, a grove of the Canadian hemlock spruce, clothing the hills between the museum building and the Bronx River and covering about forty acres, considerable portions of it being primeval.

11. The gorge of the Bronx River, extending south from the waterfall at the Mansion, along the edge of the hemlock grove. The river plunges through its gorge in a series of rapids passing into quiet waters before it leaves the Garden under the Linnaean Bridge.

12. The north meadows and river woods along the Bronx River from the northern end of the hemlock grove to the northern end of the Garden.

13. Deciduous woodlands on rocky ridges in the southern and central parts of the reservation.

14. General park features.

CONSERVATORY RANGE No. 1, AND FLOWER GARDENS

1. The Public Conservatories

Range No. 1

This great glasshouse, located but a short distance from the terminus of the Third Avenue Elevated Railway, is 512 feet in length, with a central dome about 90 feet in height, and wings extending from the main range in such a way as to form a court open to the southwest. The area under glass is about one acre. The building stands on a terrace 5 feet in height, approached by six flights of cut granite steps connecting with the path and driveway approaches. The house contains fifteen compartments, separated by glass partitions and doors.

House No. 1 contains palms of numerous species from all parts of tropical and warm regions, both of the Old World and the New. Of West Indian palms, the collection contains the royal palm of Cuba and Florida, an elegant plant of the corozo palm (*Acrocomia media*) of Porto Rico and the Windward Islands; the cocoanut palm, planted in all tropical countries for its fruit and for the numerous uses to which its fiber, wood and leaves are applied; it is not definitely known that the cocoanut palm is a native of the West Indies, and where in the tropical regions it actually originated is uncertain. Other tropical American palms are illustrated by the silvertop palm (*Coccothrinax argentea*), of Florida and the West Indies and by the curious Mexican *Acanthorhiza aculeata* with spine-like roots on its trunk. Old World species are shown in a very large tree of the Chinese fan-palm, by the date palm (*Phoenix dactylifera*) of northern Africa, and by numerous other large species from the Pacific islands. Another Old World palm is *Calamus asperrimus*, of Java, curious in its climbing habit; the specimen here is over one hundred and fifty feet long; the long tail-like appendages to the leaves, which have backwardly turned spines, enable the palm to climb on surrounding vegetation. Related to the palms and shown by numerous specimens in this house, we find a number of

species of the Panama hat-plant family, the most conspicuous being the Panama hat plant (*Carludovica palmata*), from the young leaves of which the costly Panama hats are made. Opposite the entrance to the court in this house, is a group of bamboos, which belong to the grass family, the most noteworthy of them being the Chinese bamboo (*Bambusa vulgaris*), whose stems reach into the upper part of the dome; this plant grows with great rapidity each year by new shoots which come up from under ground, our measurements showing that they reached 65 feet in height in 95 days, a rate of about 8 inches a day. The plant has been introduced into the West Indies, and in places where it grows its stems are put to a great variety of uses in construction, for water pipes and for various utensils.

House No. 2 also contains specimens of the palm and Panama hat-plant families, the smaller specimens of tropical species being exhibited here. The collections of palms now include about 175 species.

House No. 3 contains specimens illustrating several families of monocotyledonous plants of tropical regions. The amaryllis family is represented by a number of species of the spider lily (*Hymenocallis*), bearing large white flowers, the commonest being *Hymenocallis expansa* from the sandy coasts of the West Indies; large plants of the genus *Crinum*, some of which have white flowers and some red or purple, may be seen on the middle bench, and the maguey of the West Indies (a spiny-leaved relative of the century plant, native of the West Indies, and used there for hedges), on the northern bench; this name maguey is also applied in parts of the West Indies to species of *Agave*, which will be found in house 6.

Numerous representatives of the dracaena family, many of which are used for ornamental planting in the tropics, are on the north bench, with a few representatives of the same family on the west end of the south bench. Larger plants of this family will be found in house 4 adjoining. The collection of the genus *Sansevieria* is also located on

the south bench; many species yield a tough and valuable fiber from the leaves; they are commonly referred to as bowstring-hemp. The collection of screw-pines, *Pandanus*, occupies a large part of the south bench, the larger specimens being on the center bench opposite, and in the adjoining house 4.

The tacca family, *Taccaceae*, is here represented in two genera, *Tacca cristata* and *Schizocapsa plantaginea*, both on the north side of the center bench. This family is closely related to the amaryllis family.

The arrow-root family is illustrated by the arrow-root (*Maranta arundinacea*), native of South America, but widely cultivated in the West Indies, its roots furnishing the commercial product; *Calathea* comprises a large number of tropical American plants noteworthy for their fine foliage; and there are other genera represented.

House No. 4. Here are brought together many kinds of large tropical plants belonging to families also represented in the smaller houses, but too tall to be grown on the benches.

The interesting screw-pines, natives of the Old World tropics, are illustrated by several species, the leaves of which are used in the manufacture of mats, hats and baskets. These plants are not at all related to pine trees, the latter part of the name referring to the slight resemblance the leaves bear to those of pineapple plants, which are commonly called *pines* in the tropics, while the remainder of the name was suggested by the spiral arrangement of the leaves.

In this house may be found large specimens of the aroid family, the most noteworthy one of these being a magnificent plant of Veitch's tail-flower (*Anthurium Veitchii*), from Colombia, which is believed to be the most elegant plant of its kind in cultivation; climbing on trunks of trees set as supports, will be found a number of vines of the genera *Philodendron* and *Monstera*, one of these, *Monstera deliciosa*, is a Mexican plant producing an edible fruit

with the odor of pineapple. Another is *Monstera late-vaginata;* the early leaves differ widely from the mature ones. The main aroid collection will be found in house 10, and other plants at range 2.

A large tree of the common rubber plant, much grown in parlors, may be found in the center of this house, reaching to the roof; this is a native of tropical Asia and yields some rubber, but not in as great quantity nor of as good quality as the other rubber trees of South and Central America; it is a species of fig (*Ficus elastica*); other species of *Ficus* are shown in this house, notably a fine tree of Roxburgh's fig, which bears its inedible fruit in bunches near the base of the tree, and a specimen of the Banyan tree (*Ficus beng-halensis*). Chocolate trees (*Theobroma Cacao*), native of tropical America, may be found near the northern door of this house; the small white flowers are produced on the trunk and on branches, and a few of them develop into the large woody pods containing the seeds or chocolate beans, which are dried and ground up into chocolate and cocoa; specimens illustrating the chocolate industry will be found in the economic museum. The papaya, or papaw, also of tropical America, is here also; its fruit, esteemed as an aid to digestion, is borne just under the crown of leaves. A specimen of the bread-fruit tree (*Artocarpus incisa*) may also be seen here; originally from the islands of the Pacific, it was introduced into the West Indies in the latter part of the eighteenth century.

Several interesting tall vines climb on the pillars of this house, and on supports along the sides, among them the night-blooming jessamine (*Cestrum Parqui*) of tropical America, which opens its flowers after dark and exhales a delicious perfume, the flowers remaining open during part of the morning; Henderson's *Allamanda*, of Brazil, with its showy large yellow flowers, climbs to the roof.

House No. 5. The plants in this house are from desert regions. Especial attention is called to their fleshy stems or leaves which serve as storage organs for a water supply

to carry them over periods of drought. On the right hand bench, as one enters from No. 4, are mainly plants from southern Africa: the carrion flowers (*Stapelia*), relatives of our common milkweed of the roadsides; *Gasteria*, *Haworthia*, and other South African representatives of the lily family; and the fig-marigolds, *Mesembryanthemum*, belonging to the carpet-weed family.

On the end of the center bench, opposite to the entrance from house 4, is the collection of the fleshy members of the spurge family, Euphorbiaceae, mostly natives of the Old World. These closely resemble forms of the genus *Cereus* and related genera of the cactus family, to be found in houses 6 and 7. In fact the adaptation to an arid environment, by the thickening of stems or leaves, is strikingly illustrated in the plants of several families contained in the collections in houses 5 to 8. On the westerly side of the center bench are the aloes, mainly South African members of the lily family. A large part of the remaining portion of the center bench and the side bench on the east side are devoted to members of the orpine family, many of these interesting and beautiful forms. The echeverias from Mexico and Central America, and the sempervivums or house-leeks, from the Old World, are conspicuous among these. Among other genera represented are *Sedum*, *Kalanchoë*, *Pachyphytum*, and *Crassula* (in house 6 are large specimens of *Crassula portulacea*). Many of the stonecrops are hardy plants and a collection of these may be found at the herbaceous grounds. A large number of specimens belonging in this house and in the three following ones may be found during the summer in the beds in the conservatory court.

House No. 6. This is also a desert house. On the corner benches is a collection of century plants (*Agave*), a large genus known only from the New World; other and larger plants of this same genus may be found in the central portion of the house. Conspicuous among these are: the thread-bearing agave, Queen Victoria's agave, the

sisal plant (*Agave sisalana*); and the common century plant (*Agave americana*). The first two are decorative and curious; from *Agave sisalana* is manufactured the sisal hemp of commerce; the last, *Agave americana*, is well known, and it is from the sap of related species that the Mexican drink "pulque" is obtained by fermentation. It is popularly believed that the century plants flower but once in a hundred years, and then die; it is true that the plant dies when done blooming, but it blooms at a much earlier age than a century, sometimes when but eight or ten years old, it is said. The collection of West Indian Agaves is especially rich in species. A curious desert plant among the century plants on the side bench is called by the natives of Mexico, its native country, "huariqui" (*Ibervillea sonorae*); during the rainy season green stems arise from these large woody plant-bodies, which at other times remain in a resting condition.

A group of the dracaena family may be found in the central portion of this house. This comprises members of the genera *Aloe*, *Yucca* and *Dasylirion*. A group of cacti may also be seen here, the most imposing figure of which is the giant cereus, *Carnegiea gigantea*, known as "sahuaro" by the Mexicans and Indians of its native country, Arizona and Sonora. The plants here shown were obtained by an expedition sent to those regions by the Garden in 1902, and are the largest specimens in cultivation in the east. Several large specimens of the hedgehog cactus, secured at the same time, form part of this group; the Indians in the desert often secure a supply of drinking water from these plants by cutting off the top and macerating the interior substance.

Houses Nos. 7 and 8 are wholly occupied by the cactus family. The collections here have been greatly enriched and enlarged in the past few years by extensive explorations made in South America, in cooperation with the Carnegie Institution, and from other sources. These collections, the richest in species in the world, have been

assembled to facilitate the production of a monograph on this family now in course of preparation by the Garden in cooperation with the Carnegie Institution. In addition to the plants in these houses, many hundreds of others are located at the propagating houses. Nearly all these plants are devoid of leaves, these organs, when present, being mostly small and inconspicuous; in the genus *Opuntia* they are usually present on the young growths as awl-shaped bodies, while in some few species they are much larger and remain for some time; in the genus *Pereskia*, specimens of which will be found in house No. 8, the leaves are large and well developed. The stems of the cacti are fleshy and assume a great number of forms; in *Opuntia* the stem is composed of joints, either cylindric or broad and flattened. In *Cereus* and related genera the stems are angled; in *Carnegiea* they are thick massive columns with many longitudinal ribs; in *Echinocactus* the plant-bodies are but little elongated, or almost globular, while in other genera the plant-body is covered with rows of spirally arranged projections. The flowers of many cacti are exquisite in form and color; they are borne on various parts of the plant-body, in the turk's-head cactus on a curiously modified portion of the top.

In house 7 on the north bench and the north part of the center bench is the genus *Cereus* and its many related genera, *Pachycereus*, *Cephalocereus*, *Leptocereus*, *Acanthocereus*, *Nyctocereus*, *Hylocereus*, *Selenicereus*, *Harrisia*, and others. Among these is the old-man cactus, *Cephalocereus senilis*. On the west end of the center bench and on the side bench opposite is a collection of the genus *Epiphyllum*, often known as *Phyllocactus*. The broad flattened parts of these plants are stems and not leaves, the flowers being borne in the notches along their edges. The flowers are very showy; many of them beautiful in the extreme. On the south side of the center bench are plants of the hedgehog cactus, *Echinocactus*, and also of *Echinocereus* and *Echinopsis*. On the south bench is a

collection of cactuses, largely of the genus formerly known as *Mamillaria.* Here also will be found specimens of *Echinocereus*, *Echinocactus*, and of the curious Turkshead cactus which bears its flowers on the red cap to the plant, hence its popular name.

House 8 is mainly devoted to the collections of the genus *Opuntia.* On the center and north benches are the platyopuntias, those with broad flat joints, while on the south bench will be found the cylindropuntias, or those with rounded stems. Among the platyopuntias are a number of plants of Burbank's so-called spineless cactus; these were obtained direct from Mr. Burbank in 1912, and it is curious to note that many of them are now developing spines. It is claimed that these plants are valuable for fodder in arid regions. As already remarked above, the leaves of the opuntias are usually small and awl-shaped and occur on the young growths. In this house will also be found the genus *Pereskia*, in which the leaves are normally developed. One of the commonest of these is the Barbados gooseberry, *Pereskia Pereskia*, of tropical America. *Pereskiopsis* is a related genus of which a number of species will be found here and its leaves are also well developed.

An interesting economic plant in this house is *Nopalea coccinellifera*, upon which the cochineal insect breeds; it is from these insects that the dye cochineal was obtained.

Few of the cacti are of economic importance. A number of different kinds are used for hedges in tropical America. Certain species of *Opuntia* produce edible fruits known as Indian figs. These are offered for sale in the fruit stores in New York at the proper season. In the island of Grand Turk certain species of *Opuntia* which grow there are used in making a soup, known as pear soup, the young joints of the plant being used for the purpose.

House No. 9. This is the aquatic house, and plants which find their homes in the water or require much moisture are brought together here. From the bridge spanning the pool the various features may be readily observed.

Fringing the pool on the right, as one enters from house No. 10, are members of the sedge and grass families, while on the left hand side the fringe is made up entirely of grasses, largely of the graceful bamboos. Of special interest among the sedges is the Egyptian paper-plant (*Cyperus Papyrus*), from which many of the ancients obtained their writing paper. Among the grasses by far the most important is the sugar cane (*Saccharum officinarum*); from the lower portions of its stalks the juice is extracted by pressure, and from this juice sugar is manufactured. Among the plants in the pool are many with attractive flowers; conspicuous among these being water-lilies (*Castalia*), of which there are several different kinds; the water hyacinth; the parrot's-feather, with its delicate feathery masses of green; the water poppy; the water snowflake; the water lettuce and golden-club, members of the aroid family; the floating fern; and some odd little plants related to the ferns, members of the genus *Salvinia*.

House No. 10 contains specimens of the aroids, represented by a large number of different species, located on the center and end benches and also under the benches. The plants of this family (*Araceae*) are mostly of tropical distribution, but they are represented in our northern flora by the skunk cabbage, the jack-in-the-pulpit, and the sweet flag; the most familiar one in cultivation is the calla lily (*Zantedeschia aethiopica*), not botanically a lily. The plants all have spikes of very small flowers closely massed together, and usually subtended by a broad leaf-like structure which is known as the spathe; this is usually highly colored, pure white, yellow, red or scarlet, and is commonly thought of as the flower, though not botanically so; species of *Anthurium*, known as tail-flowers, are abundant in the West Indies and tropical America, as is the genus *Philodendron*, signifying tree-loving, on account of many species being vines climbing high on the trees in tropical forests; numerous species have underground stems and branches which contain much starch and are cultivated

in the tropics for food, under the name of yautias and taros. Plants of the same family, too large for exhibition in this house, may be found in house No. 4. This house is occupied also by plants of the pineapple family, these being on the side benches. These are mostly plants which live on the trunks and branches of trees in tropical forests, and are therefore called epiphytes, signifying plants growing upon other plants; many of them are exceedingly beautiful in foliage and in flower; the so-called Florida moss, or Spanish moss, clothes the trees of the live-oaks in the southern Atlantic States, and is not a moss at all, but a plant bearing small flowers which show its relationship to others of this family. The pineapple itself, doubtless the most familiar member of this group, has been cultivated in tropical regions for an indefinite period for fruit, and is not certainly known in the wild state; the pineapple fruit is the ripened bunch of flowers which forms at the top of the stem; the plant is propagated by cutting off the tuft of leaves, which is found on the top of the fruit, and by suckers which sprout from the side of the plant near the ground; it is an exception to the tree-loving habit of most of the family, in growing on the ground, and is cultivated in the Bahamas and on the Florida Keys, often in very rocky soil. One of the very spiny-leaved species, *Bromelia Pinguin* is widely utilized as a hedge plant in the West Indies. Other members of this family will be found at range 2.

House No. 11. Here are brought together many kinds of tropical plants belonging to the banana, ginger and canna families. There is also here, on a corner bench, a collection of pineapple plants, some of them with beautiful variegated foliage. The collection of bananas and their relatives occupies the greater part of the space and one or more of the specimens is usually in fruit; the collection contains both the edible, commercial bananas and the plantains, and also several species whose fruit is not edible, but whose interest lies in their decorative leaves and flowers. The

stems and leaves of all these plants contain some fiber, which is produced in enormous quantities in the Philippine Islands from *Musa textilis*, and is the well-known Manila hemp. The supply of fruit for the United States comes mostly from Central America and the West Indies, and some from northern South America. Bananas will grow in southern Florida, but the rocky soil of that region is not well adapted to their cultivation. The traveler's tree, from Madagascar, is shown in several fine specimens, and gets its English name from the fact that the axis of each long leaf-stalk contains a great deal of water which can be tapped and drunk. The bird-of-paradise plants, which take their name from their gaudy flowers, will be found in this group; they are natives of southern Africa and belong to the genus *Strelitzia*. Another genus of the banana family, *Bihai*, is also represented by several species, called wild plantains, natives mainly of tropical America.

Here also may be found several species of the genus *Costus* and of other genera of the ginger family, including the ginger plant (*Zingiber Zingiber*).

House No. 12. The plants in this house, as well as those in house No. 14, are mostly natives of warm-temperate regions, and are arranged in botanical sequence, with a view to furnishing a collection for the comparative study of plant families and genera; to make this as complete as possible, as many representatives of families and genera are brought together as space and cultural conditions permit. Cultural requirements necessitate placing the ferns and their allies somewhat out of their sequence position, at the south end of the west side bench. The east side bench is devoted to the pine family, the yew family, and to the endogenous plants, the last named terminating with the orchids, next the banana house. The sequence of exogenous plants begins on the west side bench, as one enters from house No. 13, crosses to the central bench at the ferns, and continues around that, ending in this house with the loasa family, near the fern house. The sequence is then con-

tinued in house No. 14, beginning with the mezereon family on the north side bench, at the entrance from house No. 13, continuing around the central bench and ending with the thistle family on the end of the south side bench near the entrance to house No. 13.

Among the more interesting species on the west side bench are many Australian plants, represented by grevilleas, hakeas, and others; a group of insectivorous plants may also be found here; among these are the pitcher plants (*Sarracenia*)in several species; the pitchers contain a liquid in which the insects are drowned, the fluid resulting from their decay being absorbed by the pitchers; these structures form a part of the leaves and are a modification of the petiole. The sundews (*Drosera*) secrete a sticky substance from the gland-hairs on their leaves, which can digest insects and other animal matter. On the central bench may be found a group of the rue family; to this belong, among others, the oranges and lemons, of which a number of small specimens are here, others being placed in house No. 13. A peculiar plant of this family is *Agathosma apiculata*, of southern Africa; its leaves are full of glands which secrete an oil exhaling a disagreeable odor quite apparent at times. On the east side bench are members of the lily family and the amaryllis family, with many other endogenous plants, including a collection of orchids which grow in warm temperate regions or in the mountainous sections of the tropics. In the yew family, perhaps the most interesting are two small plants of the "stinking cedar" (*Tumion taxifolium*) so-called by the natives where it grows; it is known to occur in a wild state in a small area along the Apalachicola River in Florida.

House No. 13. This house contains such plants of warm-temperate regions as are too large for proper exhibition in houses 12 and 14. The endogenous plants may be found on the side next house No. 14; the remainder of the house is occupied by exogenous plants. Opposite the entrance from house No. 14 is a group illustrating the pine family

and the yew family. The most conspicuous objects among the former are the araucarias, which take the place in the southern hemisphere of the pines in the north; *Araucaria brasiliana* and *A. Bidwillii* are prominent among these; the common Norfolk Island pine (*Araucaria excelsa*) is shown in several large specimens. To the right of this, across the path, will be found specimens of the New Zealand flax (*Phormium tenax*), and on one of the trellises in the rear is a vigorous plant of the Cherokee rose. To the left, a little beyond the pine family, is the myrtle family; prominent in this is a group of the gum-trees of Australia and Tasmania (*Eucalyptus*); these trees occur in large forests, and sometimes attain a height of 200 to 400 feet. A large specimen, some ten or twelve feet tall, of the bottle-brush tree (*Callistemon citrinus*) will be found here; the red flowers are borne in long cylindric clusters, much resembling a common bottle-brush, whence the popular name. In the corner to the right is a specimen of the camphor tree (*Cinnamomum Camphora*), from which the camphor of commerce is derived. Opposite the camphor tree is a group containing the common garden camelia, and the important commercial plant, *Thea sinensis*, from which is obtained our beverage tea; black and green teas are obtained from the same plant, the difference in color being due to the method of preparation; the tea plant is extensively cultivated in many warm and tropical countries, tea as a beverage having been used by the Chinese from time immemorial; its first introduction into Europe is said to have been by the Dutch in 1610. Further along to the left, beyond the group of Australian acacias, of which there are many specimens, are several plants of the fig tree (*Ficus Carica*), from which the edible figs are secured; the leaves drop off in winter, and so for a short time the plants are placed elsewhere. Here also is a group of oleanders; a poisonous principle occurs in the flowers and leaves of these plants, and especially in the bark. A plant of great economic importance in the olive family is the olive

tree (*Olea europaea*), of which a small specimen may be found near the oleanders; this plant was originally from the Mediterranean region and the Orient, but has now been largely introduced into cultivation in other warm countries; in the middle of the eighteenth century it was first introduced into California, at San Diego, it is said, and is now largely cultivated in southern California. On one of the columns is a fine plant of *Bougainvillaea*, a native of Brazil; the bracts which surround the small flowers are bright magenta colored; when in full bloom the plant makes a gorgeous show. On one of the trellises back of the group of the amaryllis family is a plant of the yellow jessamine (*Gelsemium sempervirens*) of the south; it sends out its pretty flowers usually in February, and they persist for several weeks. In this house may also be found a number of palms. Among these may be mentioned the characteristic fan-palm of the California desert (*Neowashingtonia robusta*), and the palmetto (*Sabal Palmetto*), of our southern States. A few temperate tree-ferns are also placed here.

House No. 14. The general arrangement of this house was mentioned when describing house No. 12. Entering from house No. 15, to the left may be found plants of the rosemary; this enjoys a reputation of long standing, for it was held in high esteem by the ancient Greeks and Romans, being regarded by them as the emblem of fidelity. A little further to the left is the parachute flower (*Ceropegia Sandersoni*), from Natal. On the right are many interesting members of the thistle family. On the other side of the house may be found *Aucuba japonica*, from Japan, and *Corokia Cotoneaster*, from New Zealand, both members of the dogwood family, but not much resembling our common flowering dogwood. Other plants of interest may also be found here.

House No. 15. The orchid family, to which this house is devoted, is a widely distributed one, occurring in all tropical regions, but finding its greatest development in the Old World in India and the Malayan region, while in the

COURT OF PUBLIC CONSERVATORIES, RANGE 1

New World its greatest numbers occur in Brazil and other parts of northern South America. In temperate regions relatively few species are found, while in very cold countries they are entirely absent. Most of the tropical forms are epiphytes, that is, they grow upon trees and usually have bulb-like or thickened stems and fleshy leaves for the conservation of their water supply, as, from their habitat, this supply must be precarious. In temperate regions nearly all of the species are terrestrial, and have thin leaves, the soil about their roots serving to protect them from the cold and also giving them a more constant water supply: they do not, therefore, need pseudobulbs or thickened stems. Coming from all parts of the world as they do, their blooming time varies greatly, so that at almost any time of the year, be it winter or summer, some of these interesting plants may be found in bloom.

At range 2 is another large collection of orchids.

On the central bench is an interesting palm, the double cocoanut (*Lodoicea maldivica*), a native of the Seychelles Islands, also known as the coco de mer, and coco des Maldives, and one of the rarest palms in cultivation. The tree in its native wilds attains a height of ninety feet, bearing aloft a magnificent crown of green leaves which make it an important feature of the landscape. This is the only plant in this house not a member of the orchid family; it is kept here for cultural reasons.

Conservatory Court. There are three attractive features here during the open season, viz., the display of tulips in the spring, followed by the collection of desert plants, and the water lily collection. The water lilies may be found in two tanks, one in each end of the court. In the easterly tank are placed the hardy sorts, such as are able to withstand the severe cold of our winters, which remain permanently where they are, winter and summer. In the westerly pool are the tender kinds, or such as require protection during the winter, and many of these are stored in a warm cellar during winter and placed on view again in the

spring. The most conspicuous of the tender sorts are the royal water-lilies from South America; these are not hardy in this climate, and, as they are too large to protect from the cold, they are grown anew from seed each year; the seeds are sown in the propagating houses late in winter, and the young plants placed on view late in the spring or in early summer.

In summer the collection of desert plants is in the beds in front of the entrance to house No. 1. The central bed contains American desert plants only, made up largely of members of the cactus, amaryllis and lily families. The bed parallelling this to the west contains a collection of cacti, members of the genus *Opuntia*, prickly pears, with flat stems or joints, all natives of the American desert. In a bed parallelling this on the opposite side of the central bed is a collection of desert plants from southern Africa. Placed transversely to this is a small bed with desert plants of one family, containing representatives from both the Old World and the New. A corresponding bed on the other side of the court is devoted to desert plants from the Old World. Near to this is a small bed containing plants of the genus *Opuntia*, only those with round stems or joints. In the corresponding bed on the other side of the court is a collection of desert plants belonging to the spurge family. Many plants from house No. 13 are also moved into this court during the summer.

Range No. 2.

This range is located on the easterly side of the grounds, in the midst of the deciduous arboretum. The completed portion consists of a transverse section, running east and west, divided into three compartments, and three houses at right angles to this one of which is divided into two compartments. The tropical ferns and their allies, most of the cycads, and parts of the orchid and pine-apple families are exhibited here. Other members of the orchid and pine-apple families and a few cycads will be found at

range 1, the orchids in houses 12 and 15, the members of the pine-apple family in house 10, and the cycads in house 1.

In house No. 1, the easterly compartment of this transverse portion, the collection of sago palms or cycads has has been installed. This family of plants is represented by large specimens of *Cycas revoluta*, from Japan; by *Cycas circinalis*, from the Molucca Islands; by a single plant of the rare *Stangeria eriopus*, from southern Africa, where it is known as the kaffir's-head; by a number of specimens of the genus *Zamia*, including the small Florida coonties; and by the Kaffir-bread (*Encephalartos*), two species, from Africa; the stems and trunks of plants of this family contain much starch, which is extracted, in the countries in which they grow, by crushing and washing, and pass into commerce under the name of sago starch. Other specimens are in the south end of the middle one of the smaller houses.

In houses 2 and 3 are the tropical tree-ferns and the larger specimens of the low ferns and fern-allies.

The graceful tree-ferns mostly inhabit the mountains of the tropics, commonly at an elevation of 1500 feet or more. Many of the plants here have been secured by Garden expeditions to different parts of the American tropics. Another feature of interest is the collection of staghorn-ferns, hanging over the walk in the center house; the application of the common name staghorn is quite evident in several of the species. Suspended from the roof in baskets are many desirable ferns. A fern from China and Tartary, known as the Scythian Lamb (*Cibotium Barometz*), may be found here; it is of interest as forming the basis of a marvellous tale, current in early times, to the effect that on a vast plain to the eastward of the Volga occurred a wonderful plant, looking like a lamb; this animal, so the story ran, was supported upon a stalk and as soon as it had exhausted the vegetation at hand died from starvation.

In house 4 is a collection of exogenous tropical plants. These are arranged in botanical sequence, the families

appearing to the right or left of the walk, or both, as cultural conditions require, the sequence beginning at the north end on the west side, terminating at the same end on the opposite side of the house. On the right, as one enters from the north door, is a collection of the pepper family, Piperaceae. These are largely of the genus *Peperomia;* many of these plants have been collected by Garden expeditions to the West Indies. Plants of the genus *Piper* are usually large, and the larger ones will be found on the center bench nearby. The nettle family follows, represented by such plants as the odd *Procris; Pilea,* in several species, including *P. microphylla,* the artillery plant; the Gyrupia poison-tree, a native of Australia, one of the most vicious of the stinging nettles—at fruiting time the dull purple of its fruit makes it quite attractive; and the two-lobed *Boehmeria,* from Japan. The flat-stemmed *Muhlenbeckia,* native of the Solomon Islands, belongs to the knotweed family. As one proceeds, many species of figs will be found on both sides of the walk, including the common rubber plant of our homes. Further on is the laurel family, one of the interesting plants belonging here being the alligator pear, the fruit of which is edible and much used as a salad and otherwise in the tropics. Near this is the custard-apple family, including the cherimoyer, an edible fruit, native of tropical America. Along the west walk, about the center of the house, are the senna and mimosa families, represented by numerous individuals. To the senna family belongs the poinciana, commonly grown in Florida and tropical countries on account of its decorative red flowers. To the mimosa family belong the sensitive plants, of which there are two here which show this characteristic noticeably, *Mimosa pudica* and *Mimosa Spegazzinii.*

Near the south end of the house is a collection of the spurge family. Here will be found the genus *Codiaeum* in many colored forms, usually known as garden crotons. Other genera represented are *Croton, Phyllanthus, Xylo-*

THE MUSEUM BUILDING AND APPROACHES

phylla, *Antidesmia*, and *Acalypha*. At the end of the house, on the west side, are two plants of the curious West Indian ivy, belonging to the genus *Marcgravia*. On the east side of the house, at the south end, is a large collection of begonias, both on the benches and planted out underneath. Further on is the meadow-beauty family, largely represented in tropical regions, to which belongs our native meadow-beauty, *Rhexia virginica*. Other families following are the vervain, acanthus, potato, Madder and thistle, the last two near the north door.

In house 5 is a collection of tropical ferns arranged in botanical sequence, thus bringing closely related families and genera into juxtaposition and enabling a comparative study of these plants to be made. It is only possible to represent in this sequence the position of the tree-ferns by very small specimens. These may be studied to better advantage in the larger houses. At the south end of this house is a part of the collection of cycads. *Microcycas calocoma*, a rare Cuban member of this family, is among these. There are a number of specimens of the American genus *Zamia*, including representatives from Florida and the West Indies. Other specimens, including the larger ones, will be found in the easterly house of the transverse range.

The easterly of the smaller houses is divided into two compartments. House 6 is known as an East Indian house. Here are grown mainly such orchids as require a close humid hot atmosphere. Among the larger and more interesting of the genera represented are: *Vanda*, widely distributed in the East Indies and the Malay Archipelago, many of them with large and showy, often sweet-scented, flowers; *Phalaenopsis*, also native in the East Indies and Malay Archipelago; *Angraecum*, of tropical Africa and the Mascarene Islands; *Macroplectrum*, from Madagascar and the Mascarene Islands; *Dendrobium*, a number of species, a large Old World genus of over 500 species; *Paphiopedilum*, Venus-slipper, an Old World representative of the

group containing our lady-slippers, *Cypripedium*. Other plants requiring this treatment are the East Indian Pitcher-plants, *Nepenthes*, a collection of which will be found here. They are mostly vines, growing naturally on trees, their leaves curiously modified at the ends into hollow structures, provided with lids, and technically known as pitchers, which are often wrongly regarded as the flowers; these pitchers contain water and secrete from their sides a liquid which digests insects that fall or crawl into the pitchers; this form of nutriment is apparently not necessary at all, however, to the growth of the plants; the flowers are small but borne in large clusters arising from the stems and may often be seen in this collection.

In house 7 is a large collection of orchids requiring cooler and less humid conditions. Large or interesting genera represented here are: *Stanhopea*, in several species, an American genus, with large odd-shaped flowers in pendulous racemes; *Epidendrum*, a large American genus, ranging from South Carolina and Alabama, through the West Indies and South America; *Gongora*, also a genus of tropical America; *Oncidium*, a large genus of tropical America, with a maximum development in South America; *Pleurothallis*, American orchids, usually small, sometimes but a half inch tall, and often forming mats on tree trunks, commonly at considerable elevations. In this house will also be found a large collection of bromeliads, of the pine-apple family, in such genera as *Tillandsia*, *Vriesia*, *Hohenbergia*, *Pitcairnia*, *Cryptanthus*, and *Aechmea*. Other representatives of this family will be found at conservatory range 1, houses 10 and 11.

Power Houses. Steam for heating the conservatories, range 1, is supplied from the power house, located near the New York Central Railroad just south of the 200th Street entrance and connected with the conservatories by a subway about six hundred feet long containing the steam mains; five boilers are installed and supply steam not only to the conservatories, but also to the museum building through another subway about twelve hundred feet in length.

MUSEUM FRONT AND BRONZE FOUNTAIN

Steam for heating the conservatories, range 2, is supplied from a boiler house near this structure, a little to the north.

2. The Botanical Museum

The Museum Building has a frontage of 312 feet, and in so far as now constructed, a depth of about 90 feet; the plan of this building contemplates its future extension toward the rear, so as to form a quadrangle enclosing a court. The architectural style of the building is Italian Renaissance. The walls are of light-colored brick and the trimmings of terra-cotta. It has a steel frame and concrete floors. Three floors are devoted to public exhibits, while the upper floor contains study rooms, the library, laboratories and herbarium, which may be used and consulted by permission.

The building is approached by two straight driveways and accompanying sidewalks leading from the main park driveway near the New York Central Railroad station; this front approach to the building is ornamented by a bronze fountain executed by the sculptor Carl E. Tefft, and by terra-cotta fountains and marble seats designed by R. W. Gibson, the architect of the building. The vista lines are formed by four parallel rows of tulip trees.

The public collections in this building are:

1. THE MUSEUM OF ECONOMIC BOTANY

This occupies the entire main floor, and comprises both crude and refined products of plants used in the arts, the sciences, and the industries, as well as illustrative photographs and drawings. The specimens are arranged as products, including foods, drugs, fibers, gums, resins, sugars, rubbers, spices and flavoring-agents, dye-stuffs, tanning-materials, plant-constituents, fixed- and volatile-oils, cork, starches, and others as indicated by the accompanying floor plan.

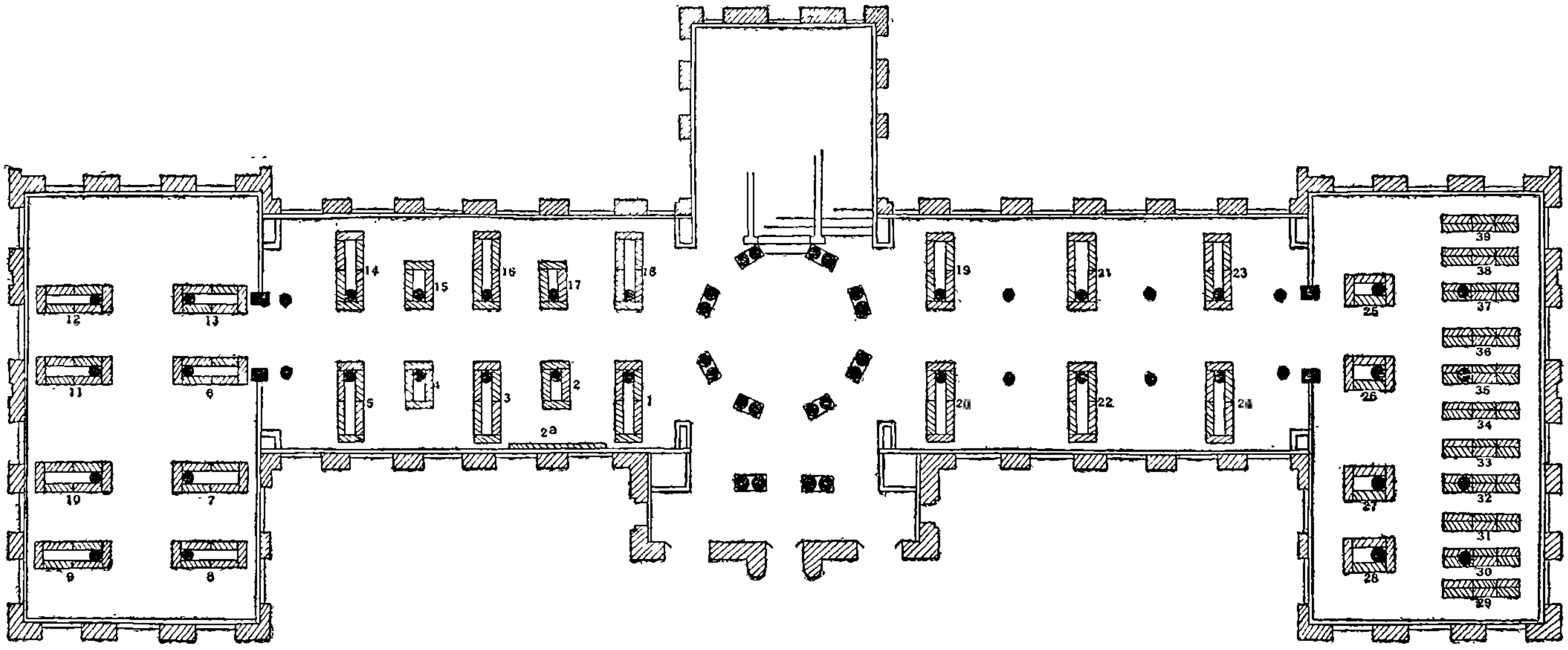
The arrangement of the larger groups is as follows: Foods and fibers occupy the west hall, the former in cases on the north side, the latter on the south. The west wing

is mainly given over to exhibits other than foods, fibers, drugs, and woods. The east hall contains the drugs, while to the east wing are assigned woods and wood-products, and a collection illustrating North American dendrology.

Fibers. Cases 1 to 26.—In the first case of the series devoted to fibers may be found cotton, now the most important of the vegetable fibers. It is derived from the fruit of the cotton plant (*Gossypium*), being the hairs that cover the surface of the seeds. The fruits from several different kinds of cotton-plants may be seen with the cotton bursting from the capsule, while some of the many different products are also shown.

The fiber of other plants, derived from leaves, stem, bark, roots, and other organs is of great economic importance and is used, either in practically its natural condition, as may be seen by the specimens of fans, hats, boxes, bags, baskets, mats, matting, crude ropes, brooms, ornaments, and toys; or it is manufactured into articles of commerce after processes which remove it considerably from its natural aspect or condition; for example, linen, which is made from the flax plant; cloth, twine, and rope, made from jute, hemp and abutilon-fiber; and paper made from wood and other fibers.

Rubber and Allied Products. Cases 27 and 29.—The first case in the west wing contains rubber and allied products. Here are the implements and utensils used in collecting the rubber "milk" from the trees which grow in tropical forests. Rubber is derived mostly from trees belonging to the mulberry family, spurge family and dogbane family. Rubber, India-rubber, or elastica consists chiefly of the peculiar substance caoutchouc, which, in the form of an emulsion, constitutes the milky juices of many plants, existing in special milk-tubes of the bark and wood. The bark is cut or punctured, when the milk exudes and is caught in some receptacle. The milk is coagulated by various methods, mostly by subjecting it to the action of



FLOOR-PLAN, MUSEUM OF ECONOMIC BOTANY

1–5. Cases 1–26 Fibers
6. Cases 27–29. Rubber and allied products
Case 30. Perfumery
6 and 7. Cases 31–35. Spices and flavoring agents
Case 36. Dye stuffs
Cases 37–38. Tanning materials
8. Cases 39 and 40. Fodder plants
Cases 41–44. Tobaccos and masticatories
9. Cases 45–49. Beverages, including chocolate
Case 50. Miscellaneous specimens
10. Cases 51–56. Fixed oils and volatile oils
11. Cases 57–62. Resins
12. Cases 63–68. Plant constituents
13. Case 69. Starches
Cases 70–72. Cork and paper
Cases 73 and 74. Sugars
14–18. Cases 75–100. Foods
19–24. Cases 101–118 and 201–218. Drugs
25–39. Cases 119–200. Woods and North American dendrology

smoke, and the coagulated mass, after losing water by slow evaporation, takes on the dark color, toughness, and elasticity characteristic of rubber. Rubber is more valuable in proportion as its percentage of caoutchouc is greater, and that of its resin less. The most important source of rubber is the tree *Hevea brasiliensis*, Para Rubber, native of Brazil, now very extensively planted in the East Indies.

Several varieties of rubber may be seen in the different stages of refinement, together with some articles as manufactured for the market. Here, too, are two allied products gutta-percha and balata, which are derived from the trunks and foliage of certain trees belonging to the sapodilla family. These trees grow in many portions of the tropics.

Perfumery. Case 30.—This case contains a collection of the essential oils and other aromatic constituents of plants which are used in the making of perfumery, together with the plant parts from which they are extracted. Two general methods are followed in the making of perfumes from such products. By the first, the aromatic and volatile constituent is extracted by distillation, a definite portion of which is then used in making a given amount of perfume. By the other, some substance, usually an odorless fat, is brought into contact with the vegetable matter containing the odorous principle, and the latter is thus permitted to diffuse itself through the fat, which is used as a perfume.

Spices and Flavoring Agents. Cases 31 to 35.—These substances form quite a large series in which is shown the parts of the plant that yield spices and flavoring extracts; for example, licorice. Licorice is the root of two species of shrubs which grow in the Mediterranean region of Europe and Asia. Spanish, French, Italian, Sicilian, or Greek licorice is the sweeter; Russian licorice is the lighter-colored. The underground runners are commonly included with the roots, but are inferior. The root contains gum, sugar, and the sweet substance glycyrrhizin, which is extracted

by boiling. The boiled liquid is strained and evaporated to form licorice extract. Some dry substance, as starch, is usually added to give it the hardness required to form "stick-licorice." The very best licorice is not made into "sticks," but is run into pans or tubs to form large, rather soft cakes. Ginger is a rootstock, the underground stem of the ginger plant; cinnamon is a bark; bay, sage, mint, and thyme are leaves; cloves are unopened flowers; mustard Tonka-bean and nutmeg are seeds, and mace is the outer coat of the nutmeg; and coriander, allspice, black-pepper, celery-seed, and caraway-seed are fruits. Vanilla, a specially cured fruit, is produced in many tropical countries, the best and highest-priced coming from the mountains of Mexico; fineness, rather than strength of odor, determines the value, and this depends upon the variety, the climate, the cultivation, and the method and care employed in curing; the wild product is the poorest. In cultivation the flowers are pollinated by hand. The fruits, resembling slender green bananas, are gathered before quite ripe and are exposed to a steam-sweating by various devices; they are then exposed to the sun each day, and wrapped in woolen blankets each night, for some time. By this process the odorous substance vanillin is developed. The vanillin may all be in the body of the vanilla ("brown beans"), or it may coat its surface in the form of shining white crystals ("frosted beans"). Before this curing process, vanilla contains no vanillin and has no special fragrance or flavor.

Dye Stuffs. Case 36.—The dye stuffs are represented by logwood, madder, alkanet-root, indigo, and oak-galls. The term "dye-stuffs" is applied to that class of vegetable products from which coloring matters useful for dyeing purposes are extracted. Such coloring matters may exist in any part of the plant, but are most often obtained from the wood, as from fustic, log-wood, and Brazil-wood. In such cases they are found in the older central tissue of the trunk, the so-called "heart-wood," but not in the outer

active tissue that constitutes the "sap-wood." From such trunks the sap-wood is therefore usually trimmed off before the logs are sent to market. In most cases, dye-stuffs show some coloration to indicate the presence of their coloring matters, although the color thus seen may be quite a different one from that which the material will produce when in practical use. Sometimes no coloration is to be seen in the dye-stuff, some chemical treatment being necessary to develop it.

Although the use of anilin or coal-tar colors has very largely replaced that of vegetable dyes, there is still a vast use of the latter. But for the introduction of the former, it is difficult to see how the demand for colors could have been supplied under modern conditions.

Tanning Materials. Cases 37 to 38.—The tanning materials are also very important from an economic standpoint. They depend for their value chiefly upon the tannic acid that they contain, but that other constituents contribute is clear from the fact that a substance containing less tannin may be more valuable than one containing a larger percentage. The tannin cures and toughens the skin, but other effects are required to produce the best quality of leather, especially that of "filling" the minute cavities. For this purpose white-oak bark seems to be preëminent and this continues to be the most valued tanning substance. It has become scarce and costly, and "oak leather"now brings the highest prices. The tannins are represented by saw-palmetto, mangrove, pine, hemlock, and sumac. The crude materials of the mangrove and the saw-palmetto are accompanied by their fluid extracts, which contain the tannic acid, and also by the spent material or refuse which remains after the extract has been made. This latter material may be used for other purposes.

Fodder Plants. Cases 39 and 40.—Following the spices are fodder plants, which are shown as sheaves. Fodders are derived chiefly from plants of the grass and bean families. Illustrations of the former are the varieties of hay

known as timothy, red-top, blue-grass, and orchard-grass. Such hays are made by cutting the plants when in bloom or early fruit, and drying entire. Another form of the same class consists of the plants of the grains, wheat, rye, oats, and corn, cut while young and dried. When dried after the removal of their grain, they constitute straw. The corn-plant, cut young, is often chopped up and stored fresh in pits and bins. Such fodder is called ensilage. The grains themselves, separated from the straw, are largely used for fodder. Illustrations of the second class are the plants of clover, vetch, lupine, meibomia, and peas, cut in a similar stage of growth and dried into hay. Fodders of this class are much more nutritious than the grass-hays, but are not so wholesome and must be fed sparingly, especially to horses.

Tobaccos and Masticatories. Cases 41 to 44.—Tobaccos are shown by a series of bundles of the cured leaves of the tobacco plants (species of *Nicotiana*) from different parts of America, and a series of articles as prepared for the market. Closely associated with tobacco are the masticatories or substances used for chewing. One of the most widely known forms is chewing gum, which is made by refining the crude chicle-gum, which is the hardened milky juice of the sapodilla and related plants. In rural districts the exudation of resin found on the bark of conifers is used for chewing while still in the crude condition, but this substance is now refined and sold in our larger cities just as is the now more commonly used chicle-gum. An adjacent series of cases is given over to:

Beverages, including Chocolate. Cases 45 to 49.—Beverages are represented by both the non-alcoholic, as coffee, tea, maté or Paraguay-tea, Jersey-tea, and fruit-juices, and the alcoholic beverages, as wine, beer, ale, and porter. Of the beverages just cited, maté or Paraguay-tea is perhaps little known in the northern hemisphere. It comes from a small tree in Paraguay and adjacent regions, and is chiefly cultivated for the production of Paraguay-tea.

The cured leaves are sold either in the entire condition or powdered, and afford the chief beverage of Paraguay and many parts of the Argentine Republic and southern Brazil. They contain much less caffeine than ordinary tea, and have a very different flavor, but are used for the same purpose and produce the same effect. Paraguay-tea is extremely cheap as compared with ordinary tea, and brief use makes people equally well satisfied with it. In the block of cases devoted to beverages may be found chocolate, which is derived from the seed of the chocolate tree (*Theobroma*). The collection shows the chocolate fruits, the principal commercial varieties of the seeds, unroasted and roasted, nibs of different degrees of fineness, germs, cocoa-liquor, cocoa-butter, cocoa-cake, and the same ground into "breakfast"-cocoa, with several varieties of confectioners' chocolate, as put up for the market.

Miscellaneous Specimens. Case 50.— In this case may be seen the substances used in the manufacture of insect-powders and related substances, and soap. Soaps are made from fats or fixed oils, acted upon while hot by a caustic alkali, or "lye," ordinarily by boiling the two together. The fat consists of one or more acids, variously combined with glycerin. The alkali takes away the acids, uniting with them to form soap, the glycerin being set free. Either animal or vegetable fats can be employed, the characters of the soaps differing more or less with the particular fat used. The character of the alkali, such as soda or potash, also modifies the quality of the soap. The soap may contain free alkali, free fat, free glycerin, or water, in variable proportions, all of which will modify its quality. Official soap (that used in medicine) should not float on water and should contain not more than 36 per cent. of water.

Fixed Oils and Volatile Oils. Cases 51 to 56.—The volatile oils form a large series, and in their manufacture various parts of the plants are used; for example, roots are used to make the oils of lovage-root, elecampane, and

muskroot; rootstocks or underground stems furnish the oils of calamus, ginger, orris-root, and wild ginger; herbage is the source of the oils of pennyroyal, tansy, spearmint, and peppermint; wood furnishes the material to make the oils of red-cedar wood and sandalwood; bark is the source of the oils of birch, cinnamon, and sassafras; leaves yield the oils of hemlock, spruce, pine, cedar, eucalyptus, and wintergreen; flowers yield the oils of cloves, lilac-flower, and orange flowers; fruits yield the oils of pepper, lemon, caraway, and fennel; seeds furnish the oils of mustard, wormseed, nutmeg, and almonds; while resins give us the oils of elemi, mastic, myrrh, and frankincense.

The fixed oils, at least from a commercial standpoint, are less numerous than the volatile oils, and those in common use are mostly derived from the fruits and seeds of plants; for example, olive-oil is contained in the fruit of the olive, linseed-oil is contained in the seed of the flax plant, castor-oil is stored up in the seed of the castor-oil plant, and cotton-oil abounds in the cotton seed. The castor-oil seed or "bean" consists, to the extent of about half its weight, of a fat or fixed oil. The ripe seeds are coarsely broken, and the shells, weighing about one third, are separated. The kernel is then pressed, and the oil squeezed out. By using heat a larger amount of oil is obtained, but the heat partly decomposes it, setting free ricinoleic acid, the result being a discoloration, a bad odor and taste, and a griping action. For this reason, it should be "cold-pressed" for medicinal purposes. In the intestines, partial decomposition of the oil occurs, whence results the purgative action. Perfectly fresh, cold-drawn castor-oil may have no disagreeable odor or taste, and has been used on bread, as a substitute for butter. The pulp remaining after the removal of the oil contains the very powerfully poisonous albuminoid, ricin. It is owing to this substance that castor-oil seeds are poisonous. About one fifth of the weight of cotton seed consists of a fat or fixed oil, the finer grades of which are largely used for

human food. This oil is both nutritious and wholesome, and furnishes a clean vegetable substitute for butter and lard, especially for cooking purposes. The poorer grades are used for soap-making and other mechanical purposes. In the process of extracting the oil the hulls are removed from the seeds and the kernels are partly cooked, after which the oil is removed by pressure. The cake that remains is ground into cotton-seed meal. This still contains considerable fat and a large amount of other nutriment and is an important food for cattle. Fixed oils differ from volatile oils in not completely evaporating when exposed to the air. In many cases the by-products resulting during the manufacture of the various oils are of considerable commercial importance. Some of these by-products are shown in the cases with the oils. In this connection are shown some vegetable waxes. These occur as exudations upon the surfaces of plants, especially those of leaves and fruits. Wax imparts a bluish-white color or "bloom" to such a surface, as upon pumpkins and grapes. Such a surface is called "glaucous" by the botanist. Another excellent illustration is the white surface upon the fruits of the bay-berry or wax-myrtle. Wax is related to fat. It is insoluble in water and is obtained by melting in hot water and skimming it from the surface. It is largely used in candle-making and also in pharmaceutical preparations.

Resins. Cases 57 and 62.—The cases devoted to resins contain on the one hand a large trunk of the long-leaf pine, in which has been cut a turpentine box, together with a series of specimens of turpentine and rosin, illustrative of the trade-classification of these products, and, on the other hand, a series of resins derived from other species of pine and related trees, and also those from trees representing the mulberry family, the mimosa family, the sumac family, and the myrrh family. An important substance derived from the turpentine of the long-leaf pine and other species of pine trees is pine tar or pix liquida. Pine tar may

be regarded as turpentine, modified and rendered impure by partial burning. It is obtained from the same trees that yield turpentine, but the dead wood and stumps are preferred. The wood is stacked and so enclosed by earth as to partly exclude air, and is then fired at the top. As the wood burns above, the heat drives out the liquid tar just below, which runs off into vats and is stored in barrels. The charcoal powder which enters renders it black. A more perfect method is to distil it in suitable retorts. By subsequent distillation of the tar, oil of tar is driven off, naval pitch being left behind. Oil of tar contains, or yields a large number of valuable substances, such as Guaiacol, creosol, naphthalene, toluene, and xylene. In addition to the resins obtained from living kinds of trees, there are fossil resins of different degrees of hardness and color; these enter largely into the manufacture of varnishes. Varnish is a solution of one or more resins in some volatile liquid which, on evaporating, deposits a uniform and continuous layer of the resin upon the surface to which the varnish was applied. Such a coating of varnish, if of good quality, is both hard and tough, hence not easily scratched, insoluble in water and waterproof, capable of taking a high polish, but melting and burning readily. Varnish resins differ in quality and value according to the degree in which the varnish made from them possesses the properties named above. The best is probably anime copal. Not only is it so hard and tough as to stand floor-wear, but it is soluble in so few substances that the spilling of most liquids upon it will not injure it. Some of the trees yielding varnish resins are now almost or quite extinct, and the lumps of resin have lain buried in the soil in a fossil state since the age when these trees were living.

Plant Constituents. Cases 63 to 68.—This exhibit consists of a series of alkaloids, acids, glucosides, amaroids, albuminoids, resinoids, and enzymes. These substances plants store up in their tissues, or in the tissues of one or more organs, and from them they are extracted for use in all branches of the arts, sciences, and industries.

Starches. Case 69.—Starch is largely formed by most plants, as a reserve food supply, from the water taken in through the roots and the carbonic acid gas inhaled from the atmosphere; the chemical combination is effected by the sun's energy, directed by the green coloring matter (chlorophyl). Starch is mostly found in the form of granules, sometimes in small rods, and is easily converted by the plant, or artificially, into glucose, in which form the plant consumes it. In darkness the plant consumes starch previously formed in daylight. Starch is insoluble in water and can therefore be easily washed out from ground plant tissue. The forms of the starch grains are so constant and characteristic in each plant that they afford an excellent method of identifying the latter, even in powder. Starch, as in the case of many other substances, exists in and is consequently derived from the several organs of various plants, for example, the roots of the cassava plant furnish the cassava flour and tapioca, while those of coontie yield coontie floor or Florida-arrowroot which is quite similar to sago, and those of the sweet-potato plant furnish sweet-potato flour. The rootstocks of the common potato plant abound in potato-flour, while those of the arrowroot plant yield arrowroot flour. The stems of some of the sago palms and those of some of the true palms are the sources of sago flour. The fruits, both dry and fleshy, of a great variety of plants, contain starch; for example, those of the several grains, wheat, rye, and corn; while those of the banana yield the less common banana flour. The seeds of some plants are used as a source of starch, as for instance, those of the chocolate plant.

Cork and Paper. Cases 70 and 72. Cork forms the outer portion of the bark of most woody stems. That of one species of oak, *Quercus Suber*, of the Mediterranean region, possesses peculiar properties of toughness, elasticity, and imperviousness to liquids and vapors which makes it useful for bottle stoppers. Many attempts have been made to find substitutes, but none have been found

to possess an equal value. It has many other important uses. After removal from the tree, and the shaving off of its gray outer layer, it is alternately beaten with mallets and heated to close up the natural fissures. Its removal does not injure the tree, since it will split off if not removed.

The cutting of cork requires extremely sharp instruments, operated by machinery running at a high rate of speed. The substance, as we are accustomed to see it, is prepared by means of boiling the cork bark and scraping off the rough outer portion. The crude cork and many manufactured articles are shown in case number 49, and a large jacket of crude cork is exhibited near by, just as it was stripped from the tree.

Wood fiber, especially that obtained from the trunks of the spruce and poplar, enters largely into the manfacture of paper. In cases 48 and 50, the fiber is shown in its crude condition and in the various stages of refinement, as well as the various qualities of paper into the structure of which it enters. Here also are the several stages and substances connected with the production of straw paper.

Sugars. Cases 73 and 74.—Sugars are formed by plants at a stage in the manufacture of carbohydrate foods, and again when the carbohydrate is used by the plant as food, as explained on our label, in the starch case. Although many varieties of sugar are recognized, they all fall into two great classes, cane-sugar and glucose. Cane-sugar occurs mostly in stems and roots, glucose in fruits. Glucose is cheaper than cane-sugar and if pure, is more healthful for human use, but the commercial article is very apt to be impure. Glucose is mostly manufactured from corn. Cane-sugar is mostly manufactured from sugar-cane, sugar beets and sorghum cane. Sugar is a very important plant-product and it is of vast economic value. Sugar-cane (*Saccharum*) is the basis of the world's sugar supply. The juice from the stems of the plant is boiled down and by other processes is made into the principal crude products shown in the cases and later into the commercial grades of sugar.

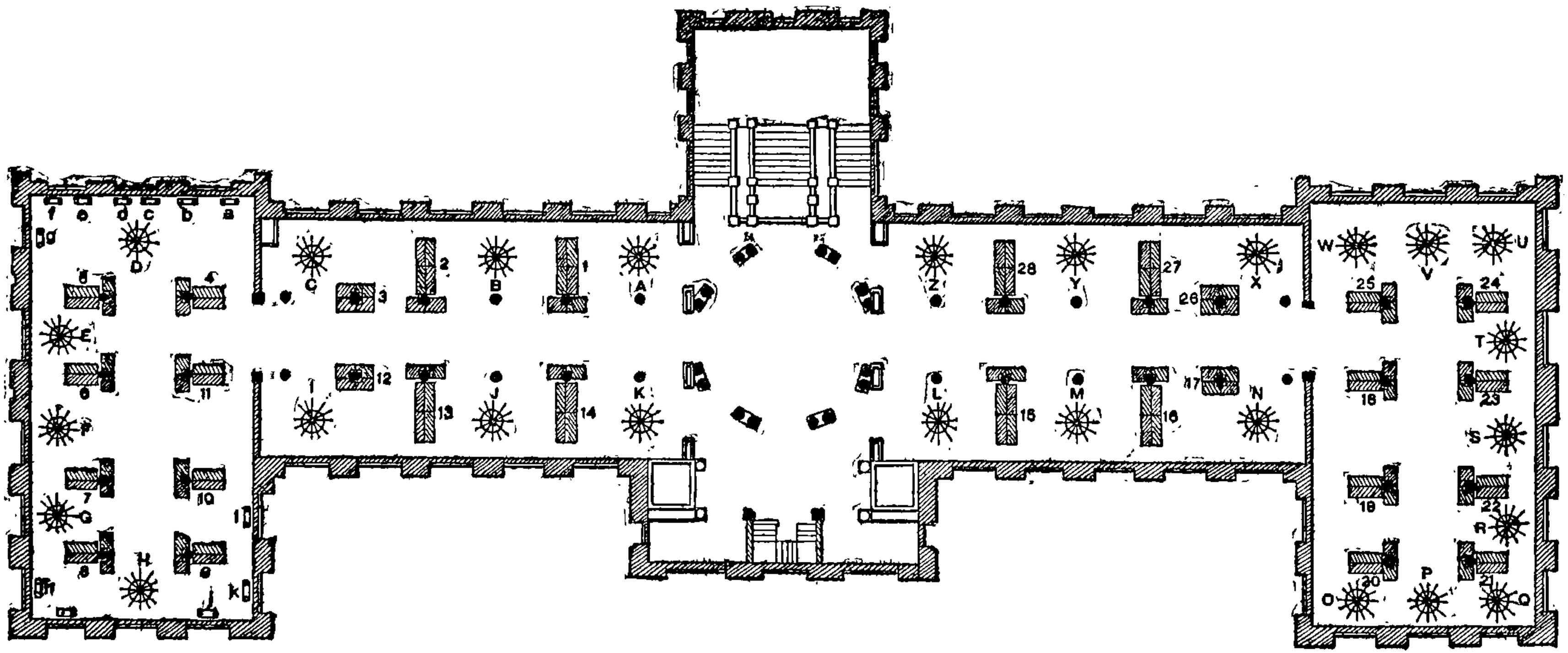
The juices of other plants are also used in making sugar, for example, in temperate regions, the sugar-beet yields an enormous amount, the sap of the maple tree is made into maple-sugar, while in tropical regions the sap of various palms, such as the coconut-palm and the sugar-palm, is made into palm-sugar.

Foods. Cases 75 to 100.—The very important section of vegetable foods occupies the cases on the north side of the west hall, opposite those containing the fibers. Here may be seen the various plants and parts of plants commonly used for food. In a few instances nearly the whole plant is available, as in the mushroom, the morel, and the truffle. Usually, however, certain parts only are nutritious or desirable; a few examples of these are as follows: sweet-potatoes, horseradish, carrots, and beets are roots; onions, potatoes, and Jerusalem-artichokes are underground stems or rootstocks; asparagus and poke-shoots are young stems; lettuce, beet-tops, spinach, and parsley are leaves; cauliflower and calamus-buds are inflorescences; corn, rice, bananas, mulberries, gooseberries, apples, tomatoes, and oranges are fruits; while peanuts, walnuts, hickorynuts, beans, almonds, and chestnuts are seeds.

Drugs. Cases 101 to 118 and 201 to 218.—The east hall is given over to drugs. This, like the department of foods, is large and important. The active principles or medicinal agents are stored up in the tissues of the plant or in the tissues of special organs. The great majority of refined drugs are derived from one or more of the parts of the plant, but in the case of the white-agaric, ergot, Irish-moss, Iceland-moss, wintergreen, sundew, bitter-sweet, penny-royal, boneset, and tansy the whole plant is used.

A few of the crude drugs arranged under the several plant-organs they represent are as follows: sarsaparilla, poke-root, rhubarb, aconite, queen's-root, senega-root, marshmallow, man-in-the-ground, and ipecac are roots; calamus, ginger, colic-root, Canadian snake-root, soapwort, mandrake, American-ipecac, buckbean, and stone-

wort are underground stems or rootstocks; sandalwood and quassia-chips are woods; sassafras-medulla is pith; birch, slippery-elm, sassafras, cinnamon, wild-cherry, horse-chestnut, cascara, linden, and cinchona are barks; laurel, hardhack, cherry-laurel, peach, senna, coca, and eucalyptus are leaves; red-clover flowers, orange-flowers, linden-flowers, heart's-ease, borage-flowers, safflower, marigold-flowers, Roman-chamomile, German-chamomile, and milfoil-flowers are flowers and flower-heads; saw-palmetto, cardamon, cubebs, hops, star-anise, poppy, rose-hips, tamarind, Tonka-bean, and colocynth are fruits; colchicum-seed, grain-of-paradise, betel-nut, mustard, delphinium-seed, almonds, calabar-bean, Barbadoes-nut, castor-oil seed, and henbane-seed are seeds. Refined drugs are well represented, among others, by gum-arabic, a gum collected from shrubs and trees of the genus *Acacia;* the most common source is *Acacia Senegal*, a large shrub or small tree growing throughout north-central and northwestern Africa. Its gum is somewhat inferior to the old-fashioned gum arabic obtained from species of northeastern Africa. The gum, which is chiefly a compound of arabic acid and calcium, exudes through orifices in the bark, resulting from the punctures of insects and in other ways. In some instances the collectors puncture the bark for the purpose of causing the exudation. When hard and dry it is collected and sent to the packing houses. Here it is assorted into grades, according to color and purity, which are sold by number. No. 1 gum arabic is nearly colorless. From gum arabic most of the better grades of mucilage are made. It is largely adulterated, especially with dextrin; such mucilage quickly turns dark. Another well-known refined drug is camphor. This important substance is collected in China and Japan, but mostly in the Island of Formosa, the Japanese government now having control of almost the entire industry. It is distilled from the chipped wood of the roots and lower part of the trunk of large trees, by natives who encamp in the forest during



FLOOR-PLAN, MUSEUM OF SYSTEMATIC BOTANY

1–28. Synoptic Collection
- 1–8. Case 1. Slime-moulds
- Cases 2–16. Sea-weeds
- Cases 17–36. Fungi
- 9–11. Cases 37–40. Hepatics
- Cases 41–48. Mosses
- 12 and 13. Cases 49–55. Ferns and Fern-allies
- 12–28. Cases 56–58. Cone-bearing Plants
- Cases 59–128. Fruit-bearing Plants

A–Z. Local Flora

a–k Microscope Exhibit

the collecting season, protected by a specially organized police force numbering several thousand men. The collectors must sell the crude camphor to the Japanese government, which refines it for the market. The government sells the refined camphor through a single agent, who is required to regulate the price in all parts of the world, to prevent speculative enterprises in it. Crude camphor is a loose, spongy, crystalline mass, saturated with camphor oil. This oil is also an important commercial article.

Woods. Cases 119 and 200.—The east wing is occupied by woods. The exhibits fall under two main divisoins, the one consisting of a series of wood-specimens from all parts of the world, and crude wood-products such as pipes, canes, shoes, sandals, utensils, and carbons or charcoals; the other being a synoptic collection illustrating North American dendrology. The wood specimens consist either of blocks of wood, or of sections of trunks with the upper part cut so as to show the long grain of the wood and also the cross grain. In the case of wood-products the crude material and the finished product is shown when possible. The collection of North American dendrology is based on specimens of the wood of all North American trees. To these wood-specimens are added specimens of the twigs, of flowers, of fruits, and of other objects of interest from the various trees.

2. THE MUSEUM OF SYSTEMATIC BOTANY

This occupies the entire second floor of the building and is designed to illustrate by specimens, drawings, and photographs, types of all the natural families of plants, beginning with those of the simplest structure and ending with the most complex. It consists of four series of objects:

(*a*) The general synoptic collection.
(*b*) A series of microscopes showing selected specimens.
(*c*) Illustrations of the local flora.
(*d*) Plant photograph exhibit.

(*a*) *Synoptic Collection.* This is designed to illustrate the plant world. A series of characteristic objects is installed as a basis for illustrating each plant-family. These specimens are accompanied as far as possible by plates, drawings or photographs, while on the shelves are arranged additional objects, such as flowers, fruits, woods, specimens of fossil plants, and models of various organs of plants, all intended further to illustrate the structural characteristics of the different groups. This collection is arranged according to the most natural and thus far most generally satisfactory interpretation of the interrelation of the plant-families; it may be considered as falling into two main series, namely, the flowerless or spore-bearing plants and the flowering or seed-bearing plants.

The flowerless plants fall into three phyla or subkingdoms: (1) the Thallophyta, in which the plant-body is not differentiated into stems and leaves, as represented by the slime-moulds, the bacteria and other micro-organisms, the seaweeds, the fungi, and the lichens (2) the Bryophyta, represented by the mosses and their immediate relatives; and (3) the Pteridophyta, including the ferns and the fern-allies.

The Thallophyta (cases 1 to 36), may be defined as plants without true roots, stems, or leaves; but notwithstanding their simple structure they exhibit an infinite variety of form and color.

The Myxomycetes or slime-moulds (case 1), standing at the bottom of the plant-scale, occupy the first exhibition case placed at the right hand side of the stairway from the main floor. They are thallophytes, having neither chlorophyl nor (in their vegetative condition) a cell-wall. These very simply constituted plants usually grow upon and derive their nourishment from decaying organic substances. They vary greatly in size, some being exceedingly minute, others assuming the form of relatively large irregularly shaped masses spreading in all directions as they grow. Most of the plants are small, and the structure is

very delicate, in fact some are so fragile that a mere breath of air will ruin them.

Following the slime-moulds stand the cases devoted to the algae or seaweeds (cases 2 to 16), which may be briefly defined as thallophytes with chlorophyl, the green coloring matter of plants. The plants of this series are much more variable in form than those of the preceding, and are also much more numerous. Some forms are microscopic, others attain considerable size. The first case of the series is occupied by representatives of the blue-green algae (case 2) and the diatoms. The plants of these two groups are minute, so much so that in most cases the individuals can be well seen only with the aid of a microscope. As one finds them in nature they commonly form slimy or oozy masses which are not particularly attractive to the naked eye, but under a compound microscope they are of very great interest. Following the series just mentioned are the green seaweeds (case 3), the group which includes the plants that are sometimes called the pond-scums, green slimes, green felts, and stoneworts. Some of these are microscopic; however, some of the green seaweeds attain a considerable size and begin to look a little more like what are popularly termed "plants." After the green seaweeds come the brown ones (cases 4 to 8), and here the largest kinds are included. In their tissues is found a brownish pigment which obscures their green coloring matter. To this group belong the widely distributed "gulf-weed" or "sargasso-weed" (*Sargassum*) and the gigantic "great kelp" of the Pacific Ocean, which sometimes attain a length of more than a hundred feet. The seaweeds culminate in the red algae, a group in which the plants show some shade of red, pink, or purple; these (cases 9 to 16) exhibit a marvelous range of form and color. The last group of cases containing this series is given to the group of red algae which are known as the corallines, on account of their outward resemblance to the corals. These plants are thoroughly permeated with lime and are often as hard

and stone-like as any coral, and build up reefs in the tropical oceans much as the corals do.

The next great type of plant life is the fungi (cases 17 to 36). These, like the plants of the preceding group, vary greatly in size and complexity of structure; but, unlike them, they are devoid of chlorophyl, the characteristic green matter which enables other plants to build up complex food for their nourishment, and consequently they are wholly different in their mode of life. Some are parasitic, deriving their nourishment from living plants and causing enormous damage to crops; others are saprophytic, deriving it from the remains of dead organisms; while others are symbiotic, living in such relationship with chlorophyl-bearing (green) plants that they mutually nourish one another, as in the case of mycorhizas. There are five generally recognized series here: First we have the stalked-spored fungi (cases 17 to 28). This series falls into two groups, the one typified by the "rusts" and "smuts" which are commonly parasitic on the leaves and fruits of other plants; the other the great saprophytic group, well known through the mushrooms, bracket-fungi, stink-horns, and puff-balls. Second in the series is the group known as the imperfect fungi (case 29). In this group the spores are borne directly on the threads or "hyphae" which constitute the vegetative portion of the organism. They are often parasitic on the leaves and on the bark of both wild and cultivated plants. Third in this series are the spore-sac fungi (cases 30 and 31). In these plants the spores are borne in delicate membranous sacs, called asci, which in the more complex forms are collected into bodies of various shapes. The plants vary greatly in size and structure and may be either parasitic or saprophytic. To this group belong the yeasts and mildews. To this group also belongs the chestnut-blight fungus. This fungus disease which has been imported into this country has caused the death of all of the American chestnut trees in the immediate vicinity of New York

City and threatens the entire destruction of this valuable tree. Some plants grow above the surface of the ground, as in the case of the morel; while others are subterranean, as in the case of truffles. In case 32 has been installed specimens and illustrations of crown-gall, an abnormal growth which is caused by minute plants known as bacteria. This peculiar growth is commonly known as vegetable cancer on account of its close resemblance to the cancer of the human body. The disease is very destructive to trees and shrubs of various kinds. Next in order are the alga-like fungi; these vary in form from simple masses of protoplasm to simple or branching threads. Here belong many of the moulds and similar forms which grow both on other plants and on animals. The fifth and in many respects the most interesting of all the groups is that consisting of the lichens (cases 33 to 36). The lichens have commonly been considered to form an independent symbiotic group, each lichen being supposed to consist of a fungus and an alga living together, the one nourishing the other, but, according to some of the more recent students of the group, the lichens are simply fungi that live parasitically upon algae. The lichens are quite familiar to most people as plants of more or less leathery texture growing on rocks, on poor soil or on the trunks of trees.

A step forward brings us to the Bryophyta. These are seedless green plants, most of which possess roots, stems, and leaves, but have no vascular tissue (cases 37 to 48). This group is best known through the mosses, which form its largest division. Of somewhat simpler structure are the hepatics or scale-mosses (cases 37 to 40). The stems and leaves of the hepatic plant are sometimes combined into a flat thallus-like body which creeps closely on the ground or other objects and resembles in aspect some of the lichens. The leaves, when present, are usually more delicate in texture than in the true mosses and they do not have a midvein. These differences alone enable one to distinguish a hepatic from its relatives by the unaided eye or at

most by the use of a lens. In addition to these characters, the capsule or the receptacle which bears the spores, or reproductive bodies, usually splits into four valves when full-grown and the spores themselves are accompanied by spiral threads called elaters. The favorite habitat of hepatics is wet places, and mountains continually steeped in clouds yield a surprising variety of forms. Closely related to the hepatics, and commonly included with them, is the group Anthocerotes; these plants may, however, be distinguished by the presence of a central axis or column (columella) in the capsule, and there are several other important structural differences in their tissues.

The mosses (cases 41 to 48) follow the hepatics in order of development and complexity; they differ from them, however, in many respects. The stem and leaves have more differentiated tissues, and the leaves usually have a midvein. The moss capsule generally opens by a lid under which there are commonly appendages to aid in scattering the spores, which in this case are not accompanied by spiral threads as they are in the hepatics. The mosses fall into three primary groups: First the "peat-mosses" (*Sphagnum*), which differ from the rest of the mosses in the development of the tissue-structure of the capsule and in the spores; they grow in swamps and other wet places, and their accumulation forms peat. The "black mosses" (*Andreaea*) differ from both of the other groups in the valvular capsule; they grow on dry rocks. The true mosses vary exceedingly in size and aspect. An examination of the specimens in the exhibition cases will convey to the mind a better idea of this group than may be gained from a description. They grow under all kinds of conditions from dry rocks to deep water. Many of the kinds grow on almost any kind of rock, earth, or bark of trees, while certain ones are more particular as to their habitat. Some will thrive only on limestone, which they often gradually disintegrate and partially preserve in the masses of closely set plants as a calcareous tufa; other species prefer ground

that has recently been burnt over, as species of *Funaria* and *Leptobryum*, while others grow only on the bones of dead animals or in places where animal refuse has accumulated.

Next higher in the plant kingdom is the subkingdom Pteridophyta, or ferns and fern-allies, the seedless plants with roots, stems, leaves, and woody tissue (cases 49 to 55). The ferns as a group perhaps attract the attention of a greater number of people than any other series of plants. Associated with what are usually known as ferns are the fern-allies, for example the "horse-tails" (*Equisetum*), "lycopods" (*Lycopodium*), and "quillworts" (*Isoetes*), but these are usually less conspicuous than the "ferns." Fern-plants differ from all the plants of simpler organization in having vascular (woody) tissue, that is, a system of vessels for conducting sap through the different parts of the plant-body. They exhibit an almost infinite variety of form; their stems may be underground, horizontal on the ground, or erect; the leaves are either simple or compound, and sometimes perform both the work of foliage leaves and that of bearing the spore-cases (ferns), while in other cases some of the leaves have become changed into mere spore-bearing organs (cinnamon-fern).

The "flowering" plants (cases 56 to 128) comprise a single subkingdom, the Spermatophyta, or seed-bearing plants. This extensive group seems to have followed two independent lines of development and consequently the plants fall into two well marked groups, the first being the gymnosperms, cone-bearing plants, or plants in which the seeds are borne exposed in variously shaped cones (cases 56 to 58). This is a comparatively small group, but exhibits great diversity, including plants ranging from straggling shrubs or vines to the largest trees. The leaves, too, vary from structures resembling needles or scales to expanded fern-like structures of considerable variety. In a former geological age these plants were the dominant seed-bearing plants, but now the second group of the sper-

matophytes largely predominates; namely, the angiosperms, covered-seeded plants in which the seed is borne in a seed-case. These plants also existed in the later geological ages, and now form the most important and conspicuous part of the vegetation of the earth. The covered-seeded plants (cases 59 to 128) fall into two divisions, the one in which the embryo has a single leaf, the monocotyledons (cases 59 to 71); the other in which the embryo has two leaves, the dicotyledons (cases 72 to 128).

(*b*) *Microscope Exhibit.* The exhibition microscopes occupy small stands in the west wing of the second floor. In front of the windows on the right as one enters the wing are shown a few of the simplest and smallest forms of plant life. Under the lenses of the first microscope are representatives of the diatoms—one-celled organisms, some of which have the power of animal-like locomotion; the living substance of each cell is enclosed and protected by a hard transparent glassy wall consisting of two halves, one of which fits into the other like a band-box into its cover. The second microscope shows attractive and varied forms of fossil diatoms from California. Following this are shown "sea mosses," or "seaweeds," as they are commonly known, and closely related minute plants which inhabit fresh water and belong to groups often referred to in popular speech as "pond-scums" or ooze." In the natural unmagnified condition, many plants of this sort seem quite the reverse of attractive, but when placed under a sufficiently powerful microscope many of them reveal a rare beauty. The "sea mosses," or "seaweeds," gradually lose much of their natural beauty of coloration on prolonged exposure to the light, but the prevailing elegance and symmetry of form and structure persist.

Following the plants of the seaweed type are several representatives of the smaller fungi. The first of these specimens illustrates the resting spores of the parasitic fungus that causes the well-known rust of rose leaves. The second shows a vertical section through the cluster-cup

stage of a fungus that draws its nourishment from the living tissues of the leaves of violets. Of the fungi which live upon decaying refuse matter, *Ascobolus* is one of the more interesting among those selected for exhibition. In this, the spores, or propagating cells, are borne in groups of eight within transparent ellipsoidal sacs, and at maturity these sacs, each enclosing eight spores, are ejected with considerable force. Under the next microscope are shown sections through the gills of a common mushroom, illustrating the manner in which its very minute and numerous spores are borne.

Then follow specimens of the liverworts or scale-mosses, plants in which the differentiation of the vegetative body into stem and leaves becomes first clearly evident. One of these, a *Frullania*, has a part of each leaf peculiarly modified so as to form a reservoir for water. By aid of this device, the frullanias and their allies are able to thrive in drier situations than are in favor with most of the order to which they belong. Preparations are exhibited showing also the vegetative structure and methods of reproduction of the true mosses. Especially interesting is the "peristome" of one of the mosses, which is a fringe of peculiar appendages surrounding the mouth of the little urn in which the minute dust-like spores are borne. These appendages move about as a result of changing conditions of moisture and these mechanical movements assist in scattering the spores. A somewhat analogous device is found in connection with the spores of the equisetums or horsetails, though the appendages in this case are attached to the spores. Near the slide illustrating this feature of the horse-tails is one showing the spores and spore-cases of the common polypody; the spore-case here is provided with a sort of spring, by the action of which the spores are violently ejected, catapult-fashion. Another preparation shows the structure of the stem of the moonwort (*Botrychium*) as it appears in a cross section. Another illustrates the structure of the wood of a young pine stem in cross

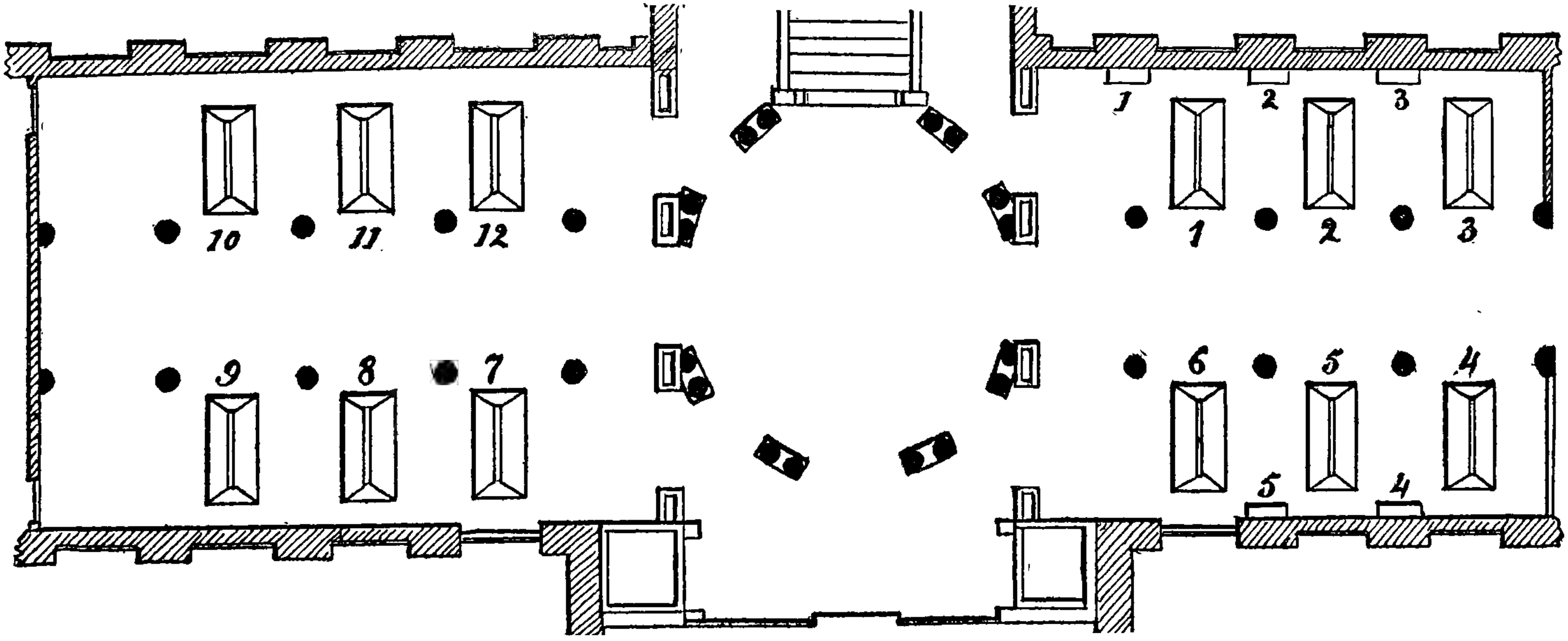
section and brings out clearly the anatomical basis of the annual growth rings. And yet another shows a cross section of the submerged stem of an aquatic plant with its large air spaces and poorly developed strengthening tissues.

(*c*) *Local Flora.* In this collection it is designed to illustrate every plant-species growing naturally or without cultivation within one hundred miles of New York City. For the most part specimens of the plants themselves are used, but in cases where the structure of the plants renders this method undesirable, or impossible, a photograph or a drawing is substituted for the plant-specimen. This collection is displayed in swinging frames which are placed so as to correspond in a general way to the sequence of the cases of the synoptic collection already described; thus, the first stand is near the first museum case as one enters the west hall from the top of the staircase. All of the plant groups are here represented by those members that occur locally, and the characteristics of the several groups as mentioned under the Synoptic Collection also apply here.

(*d*) *The Plant Photograph Exhibit.* A series of over 200 enlarged photographs, illustrating plant societies, habit-characters, flower-characters, and fruit-characters of the higher plants, as well as habit and structural characters of some of the larger algae and fungi, are displayed in frames fastened to the walls of the systematic museum. As far as practicable, they have been placed near the cases containing representatives of the species illustrated. The photographs are 11 x 14 inches in size and are mounted in glazed frames, some frames containing 4 and others 6 photographs.

3. THE MUSEUM OF FOSSIL BOTANY

This collection, installed in the basement, is designed to show the successive stages of evolution through which the ancestors of our living flora have passed since the time of



FLOOR PLAN, MUSEUM OF FOSSIL BOTANY

Floor and wall cases 1. Plants of Eozoic Time, Laurentian Period, and Paleozoic Time, Cambrian, Silurian, Devonian and Carboniferous Periods

Floor and wall cases 2–4. Plants of Paleozoic Time, Carboniferous Period

Floor case 5. Plants of Mesozoic Time, Triassic and Jurassic Periods

Wall case 5. Specimens showing methods of fossilization

Floor case 6. Plants of Mesozoic Time, Cretaceous Period (Raritan)

Floor case 7. Plants of Mesozoic Time, Cretaceous Period (Raritan and Cliffwood)

Floor case 8. Plants of Mesozoic Time, Cretaceous Period (Dakota)

Floor case 9. Plants of Mesozoic Time, Cretaceous Period (Laramie)

Floor case 10. Plants of Neozoic Time, Tertiary Period (Eocene)

Floor case 11. Plants of Neozoic Time, Tertiary Period (Miocene)

Floor case 12. Plants of Neozoic Time, Tertiary (Miocene and Pliocene) and Quaternary Periods

the first appearance of plant life on the earth, as far as the remains of extinct plants have been preserved. The general arrangement adopted is therefore based upon the sequence of the geological time divisions: Eozoic, Paleozoic, Mesozoic and Neozoic, and their subdivisions into periods; Laurentian, Cambrian, Lower Silurian, Upper Silurian, Devonian, Carboniferous, Triassic, Jurassic, Cretaceous, Tertiary, Quaternary and Modern. This arrangement is therefore geological, but incidentally it is also biological, and follows the same system as that on which the synoptic collection of the museum of systematic botany is arranged, inasmuch as the plants of the earlier periods are low in the scale of life, consisting of thallophytes and pteridophytes and plants of uncertain botanical determination, while those which appear in the successively later periods are of successively higher and more complex types, represented by cycads, conifers and both monocotyledonous and dicotyledonous plants closely related to our living flora.

Each specimen on display, with the exception of the very large ones, is placed upon a separate wooden block, and each one is labeled, giving the generic and specific name; the family, order or class of plants to which it is referred; the geologic period and subdivision in which it belongs, and the locality or region where it was collected. All essential information of a botanical and geological nature in relation to each specimen is, therefore, included in the label. Whenever a figure of any specimen can be obtained this is placed on the same block with the specimen, and pictures of ideal landscapes, showing the extinct vegetation of certain geologic periods, as well as restoration of certain extinct plants, are displayed in their proper cases. The series of exhibits begins in the first cases to the left as one enters the east hall of the basement. The sequence of the specimens in the wall cases corresponds to that of the floor cases.

In floor- and wall-cases Nos. 1 to 4 may be seen representatives of Eozoic and Paleozoic Time: Laurentian,

Cambrian, Lower Silurian, Upper Silurian, Devonian and Carboniferous Periods. In floor- and wall-case No. 1 are specimens of graphite of eozoic age and of anthracite and bituminous coal or carboniferous age, showing the transformation of vegetable matter into the ultimate condition of pure carbon in the form of graphite or "black lead" in the oldest rocks. Other specimens in this case, classed as algae, are of uncertain botanical relationship, as the structure of the primitive plants was not well adapted for preservation as fossils. For example, some organisms appear as mere filamentous strips of graphite in white limestone, without any trace of the original structure remaining, while others may be seen as casts and impressions which closely simulate in general appearance different parts of the seaweeds now existing. In this series of problematic fossils are also included a number of forms at one time definitely classed as plants but now by some assumed to be of animal or inorganic origin; namely, *Scolithus*, which may be caused by worm burrows; *Phytopsis*, which may be a coral; *Plumalina*, which may be a hydroid; *Dendrophycus*, which may be current-markings; and Dictyolites, which are most likely sun-cracks. All of these, however, have at one time or another been definitely regarded as the remains of marine plants and were originally so described and classified.

In these cases and in wall-case No. 2 are also the remains of the earliest fern-plants and their allies (Pteridophyta) of Devonian and Carboniferous age, represented by *Lepidodendron*, *Sigillaria* and *Calamites*, and the early seed-bearing plants, the cone-bearers (Gymnosperms), represented by *Cordaites*, with the fossils under *Trigonocarpon*, *Rhabdocarpon* and other genera.

Floor-cases Nos. 2 and 3 and wall-case No. 3 contain specimens of Carboniferous age, for the most part ferns or fern-like plants, which were originally described as ferns, but which are now placed in a different group, the Cycadofilicales, that is, plants that had characteristics of both

the ferns and the sago-palms, but more closely related to the latter than to the ferns.

Floor- and wall-cases No. 4 are devoted to specimens of Carboniferous plants in the genera *Lepidodendron*, *Sigillaria* and *Stigmaria*, in order to show the variation in the arrangement and shape of the leaf scars and the difference between specimens with the bark preserved and those which have been decorticated.

Floor-case No. 5 contains types of early Mesozoic time: Triassic and Jurassic Periods. The plant remains in this case are mostly sago-palms or cycads, with a few cone-bearers and fern-plants, besides specimens of the so-called "*Glossopteris* flora," a flora of uncertain botanical relationship, which flourished in the transition period between Paleozoic and Mesozoic time, particularly in the southern hemisphere, and may yet be represented by the living South African genus *Stangeria*, a cycad having leaves with pinnately arranged forking veins, similar to ferns.

Floor-case No. 6 encloses plant remains from the rocks of later Mesozoic time: Lower and Middle Cretaceous Period. These specimens represent the first appearance of the higher-seed-bearing plants (Angiosperms), the type which is dominant in the existing flora. The genera are in most instances apparently identical with those now in existence, but the species are extinct. The plants of the Lower Cretaceous consist largely of ferns and cone-bearers, while those of the middle Cretaceous show a preponderance of angiosperms.

Floor-case No. 7 is arranged to show specimens of the Middle Cretaceous flora found within the limits of the City of New York, on Staten Island, or in the immediate vicinity in New Jersey and on Long Island.

Floor-case No. 8 contains specimens from the Middle Cretaceous of the western States. Those from the Dakota Group are exceptionally fine, many of them being perfectly preserved and showing both case and impression of the same leaf as counterparts.

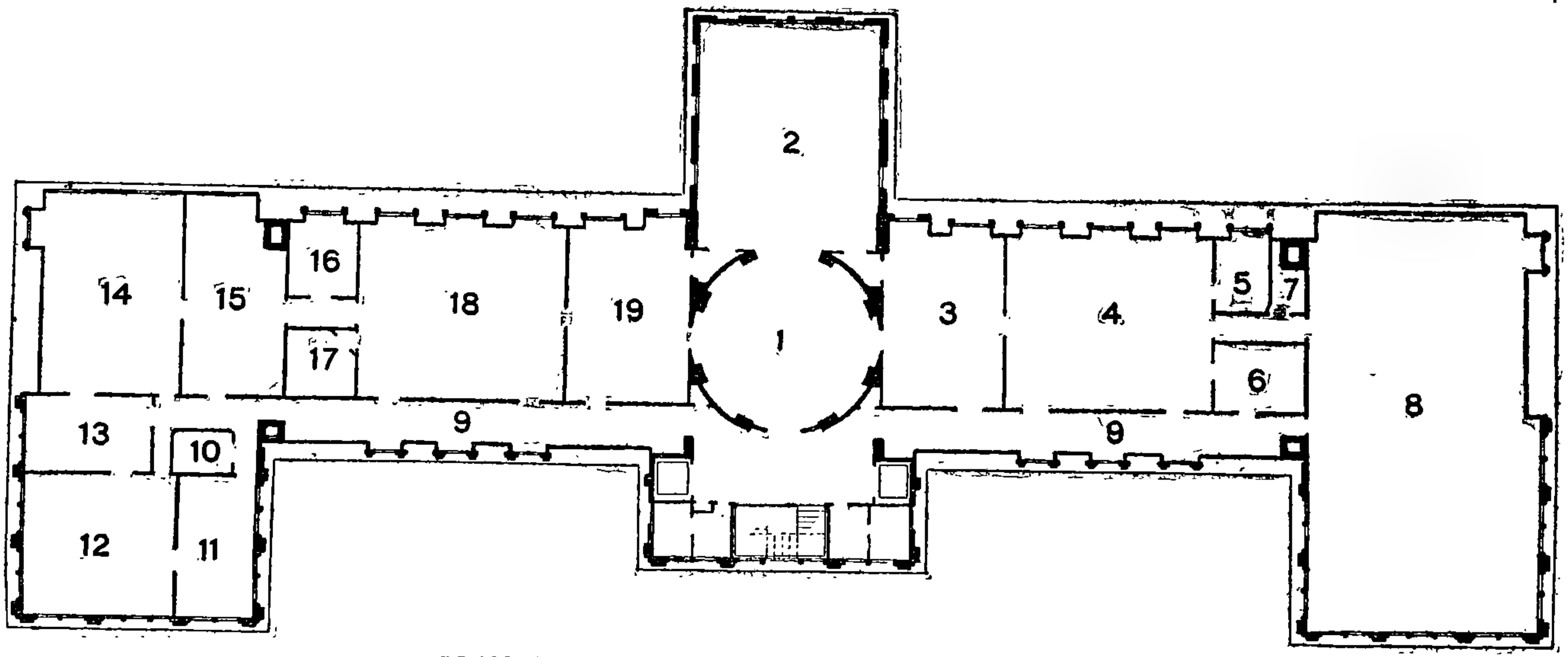
Floor-case No. 9 is devoted to plants of the Upper Cretaceous (Laramie Group), and completes the vegetation of Mesozoic time.

Floor-cases Nos. 10 to 12 and wall-case No. 5 contain plant remains of Neozoic time. Those of the early Tertiary Period (Eocene) are displayed in floor-case No. 10. Those of the later Tertiary (Miocene) and Quaternary Periods in floor-cases Nos. 11 and 12. The specimens in the latter case complete the sequence of plant life on the earth and bring it up to modern times. A number of specimens at one end of the case show the methods of preservation by petrifaction, incrustation and carbonization, and on the upper shelf is a series of specimens from Quaternary and more recent swamp deposits which show how the conversion of living plants into fossils, a process now going on, has its beginning.

The specimens in wall-case No. 5 further illustrate the characteristics of the plants of the late geological periods and the methods by which the various plant structures have been preserved. A number of specimens of silicified woods show the method of preservation by what is known as petrifaction, or conversion into stone, in which the woody structure is replaced by mineral matter. Other specimens show preservation by incrustation, in which mosses and the stems of reeds are coated or incrusted by mineral matter deposited from springs; while on the upper shelf on the top of the case are logs and stumps from old swamps and interglacial deposits, in which the wood has been partially carbonized, or converted into lignite, by the slow process of natural distillation. This process represents the beginning of the conversion of vegetable tissue into coal.

LECTURES

Other features of the museum building include the large public lecture hall, with a seating capacity of over seven hundred, which occupies the western end of the basement. It is equipped with an electric projection-lantern, and free



PLAN OF UPPER FLOOR OF MUSEUM BUILDING

1. Library Reading Room
2. Library Stack Room
3. Herbarium of Algae
4. Herbarium of Ferns and Lichens
5. Curator's Room
6. Moss Herbarium
7. Storeroom
8. Main Herbarium
9. Hall
10. Photographic Dark Room
11. Work Room
12. Chemical Laboratory
13. Study
14. Herbarium of Fungi
15. Study
16. Study
17. Physiological Dark Room
18. Botanical Laboratory
19. Library Extension

public popular lectures covering a wide field of botanical and horticultural subjects are delivered here on Saturday afternoons from spring to autumn; these are fully illustrated by means of a very extensive collection of lantern slides owned by the Garden which is constantly being increased. A noteworthy part of this collection is the series of delicately and accurately colored slides of flowers, fruits, trees and shrubs, by Mrs. Adelaide S. Van Brunt, from photographs made during many years by her late husband, Cornelius Van Brunt.

The Horticultural Society of New York holds several of its monthly meetings at the Garden, using the large lecture hall, and also uses the basement museum hall adjacent for the purpose of exhibitions.

The Torrey Botanical Club holds monthly meetings from October to May, on the afternoon of the last Wednesday of each month, in the museum building, and many of its field meetings on Saturday afternoons throughout the season are held at the Garden.

THE LIBRARY

The library of the Garden is located in the center of the upper floor of the museum building, and is available for consultation, by permission. It has been formed by the Board of Managers in order to provide for the use of students, all the literature of botany, horticulture and related sciences, and is rapidly becoming one of the most complete collections of books and pamphlets in the world dealing with these subjects. It consists of a reading room, circular in shape, and two stack rooms opening off from it. The collection contains over 28,000 bound volumes.

In addition to its own books, the library has on deposit many of the botanical works belonging to Columbia University and the New York Academy of Sciences.

The Cox collection of Darwiniana, named in honor of the late Charles Finney Cox, by whom the collection was made, consists of a complete set of the works of Darwin.

These books occupy a specially constructed cabinet which stands near the center of the reading room.

Manuscript letters of botanists, as well as many portraits of botanists, are also on file.

THE HERBARIUM

The herbarium consists of dried specimens of plants systematically arranged in cases; it occupies the greater portion of several rooms on the upper floor of the museum building, and is available for consultation by permission. It contains prepared specimens of all kinds of plants from all quaters of the globe, and is the most extensive and complete collection of its kind in America. It comprises the Garden herbarium and the Columbia University herbarium. The latter is one of the oldest collections of its kind in the United States, having been begun by Dr. John Torrey soon after the commencement of the last century. After half a century of natural growth several large herbaria were incorporated in it and large sets of special collections were added to it. The Garden herbarium was begun with the inception of the Garden. It has grown rapidly and now far excels the Columbia herbarium in the number of specimens. The rapid growth of the Garden herbarium and its importance is due to the fact that it is built up of approximately thirty different herbaria which represent plants of all groups from all parts of the globe. To this as a basis have been added miscellaneous collections and the first sets of the plants secured by members of the Garden staff while exploring in different parts of the New World and the Old.

The great majority of specimens are mounted on herbarium sheets, but many thousand specimens, such as bulky fungi, fruits, seeds, and other parts of plants not suitable for placing flat on herbarium sheets are contained in cardboard boxes of multiple sizes.

The herbarium now comprises approximately one and one-half million specimens. All groups of the flowerless plants and flowering plants are copiously represented.

THE LABORATORIES

Laboratories and working rooms for research are provided on the upper floor of the museum building, and properly qualified students of botany are permitted to make use of this equipment, under the direction of some member of the staff of the Garden. The equipment is designed to meet the needs of a very broad field of investigation including plant chemistry, pathology, physiology and morphology. An experimental garden and greenhouse at the nurseries are used in connection with the laboratories. A valuable series of old microscopes, illustrating the history and development of that instrument, was presented by the late Mr. Charles F. Cox.

3. The Pinetum

[COLLECTION OF CONE-BEARING TREES]

The collection of cone-bearing trees, technically known as the Pinetum, because the pines are the most abundant of these trees, is planted over a space of about 30 acres in the southwestern part of the grounds, extending from the approach to the elevated railway station southeast to the herbaceous garden, and northeast to the museum building and the borders of the hemlock forest. The species of trees are grouped in genera, which are mostly separated by paths. The planting out of these trees was commenced in 1901; the collection will continually become more complete year by year as additional species are secured; many of these have to be raised from seed, and the process of establishing a collection of conifers thus requires much time.

Commencing at the approach to the elevated railway station we find the Douglas spruce (*Pseudotsuga mucronata*) planted in the space between the traffic road and the park driveway to the left of the path leading to the conservatories; this tree is a native of western North America from the Rocky Mountains to the Pacific Coast and is sometimes known as red fir; in the far northwest it sometimes becomes 180 to 210 feet high, its trunk occasionally as much

as 3½ feet in diameter, but in the Rocky Mountains it is seldom one-half this size, and trees taken from the far northwest do not thrive well on the Atlantic coast, owing to the much greater rainfall which they naturally receive there; the cones of the Douglas spruce are from 2 to 4 inches long, pendant on the branches, their scales rounded and shorter than the bracts which project beyond them.

The hemlock spruces (*Tsuga*) are planted between the approach to the elevated railway station and the power house, and are represented by the Canadian hemlock spruce (*Tsuga canadensis*), the same species which forms the interesting forest on the hills bordering the Bronx River, and indicated on the general plan of the Garden as the hemlock grove. This tree occasionally becomes about 90 feet high, with a trunk up to 12 feet in diameter, and is distributed throughout northeastern North America, extending southward along the mountains to Alabama, northward to Nova Scotia and westward to Minnesota. Its bark is the most important tanning substance in the United States and a great many trees are annually felled to obtain it; its wood furnishes a cheap lumber of little strength and durability. The weeping hemlock (*Tsuga canadensis pendula*) is one of the most beautiful dwarf evergreens. The Carolina hemlock (*Tsuga caroliniana*), from the mountains of southern Virginia to Georgia, may also be seen here, as well as the Japanese hemlock spruce (*Tsuga Tsuga*), to which the name *Tsuga* was first applied. The hairy-twigged Japanese hemlock, *Tsuga diversifolia*, is also here.

In the area to the westward of the conservatories, extending to the west border, and bounded by paths on the north and south, are the firs (*Abies*). These can at once be distinguished from the spruces (*Picea*) by the erect, instead of pendulous, cones, and by the smooth branchlets. The wood of the firs is usually soft and not durable, so it makes poor lumber. Specimens of the balsam fir will be found here; this is widely distributed over northern North America, and from it is obtained canada balsam or balm of

fir, used in the arts and in medicine. The Japanese silver fir is an attractive plant, with its dark green stiff foliage. Veitch's silver fir, from Japan, and said also to occur on the neighboring coast of Manchuria, is one of the best for ornamental purposes. It was discovered in 1860 on the famous Japanese mountain, Fuji-yama, by Mr. Veitch, for whom it is named. The red fir, from Washington and Oregon, with its blue leaves, borne almost erect and apparently on but one side of the branchlets, makes a conspicuous object. In its native country it sometimes attains a height of 250 feet. Its wood is sometimes used in the interior finishing of buildings. Among other firs here are: the white fir, from western North America, sometimes growing to a height of 200 to 250 feet; the Siberian fir, from northern Europe and Asia, yielding a soft lumber in general use and a bark used in tanning leather; the common silver fir, from Europe; Nordmann's silver fir, from the Caucasus; the Sicilian silver fir, from Asia Minor; and the Nikko silver fir, from Japan.

The spruces (*Picea*) are located in the area to the northeast of the firs. Some of the spruces are most valuable timber trees. The oriental spruce, from Asia Minor, is present in several specimens. One of the hardiest spruces for our climate, and a general favorite, is the Colorado spruce. This will be found here in the green form; also variety *glauca*, variety *Kosteri*, the blue color of the young leaves more marked than in *glauca*, and a pendulous form of variety *Kosteri*. It usually grows about 100 feet tall in its native country. The Norway spruce, with a number of horticultural forms, are brought together to the west of the group of golden bells or Forsythia near the Garden station plaza. It is a commonly cultivated tree and furnishes a useful timber, which is known as "white deal" in England, and is largely used in the manufacture of musical instruments. The resinous exudation of this tree is known as Burgundy pitch, which, in combination with other ingredients, is used in Europe to line beer casks.

Other spruces of interest here are the Yesso spruce, the wood of which is much used in Japan; the white, or Engelmann's, spruce, from western North America, the wood of which is largely manufactured into lumber and the bark sometimes used in tanning; the Servian spruce, one of the largest and most valuable timber trees of Europe; and the tiger's-tail spruce, from Japan, introduced about forty years ago, and one of the hardiest Asiatic species in cultivation.

The space allotted to the pines (*Pinus*) embraces the region to the eastward of the spruces and public conservatories, range 1, extending across the road to the herbaceous grounds. Most of the pines are of great economic importance, furnishing large quantities of lumber, turpentine and resin. Most of the white pines will be found on the westerly ridge of the herbaceous grounds and across the road from this to the eastward of the conservatories. Among these is our common white pine, which is perhaps the most valuable of the timber trees of northeastern North America, large quantities of lumber being derived from it. Near this is the Himalayan pine, resembling it, but with longer drooping leaves and the cones borne on long stalks; this sometimes attains a height of 150 feet in its native country, where its lumber is much used for building and other purposes. In this region will also be found the Cembra or Swiss stone pine, of southern Europe and northern Asia; and the Macedonian pine, of southeastern Europe.

In the area to the eastward of the conservatories will be found, among others, the Corsican pine, with a hard, strong wood which is much used; the variegated Scotch pine, with the young leaves variegated; and a number of plants of both the white pine, Himalayan pine and Corsican pine.

In the region to the north of the white pine tract, and on the westerly side of the herbaceous grounds ridge, will be found the Tyrolese mountain pine, from the Tyrolese and Venetian Alps, forming a group of some dozen plants; near

VIEW IN THE PINETUM, THE MUSEUM BUILDING IN THE DISTANCE

this is the Japanese red pine, and several horticultural forms of it, from Japan. Following these to the north are a number of plants of the Jack pine, or Banks' pine, native of northern North America. Its wood is sometimes used for fuel, and was valued by the Indians for the frames of canoes.

In the area to the eastward of the spruces are a number of other pines. The Corean pine, one of the white pines and a native of eastern Asia, is located next to the spruces. Near this is the Table-mountain pine. On the high ground to the eastward of the above is the Scotch pine, the principal timber pine of Europe and Asiatic Russia. On the easterly slope of this higher land and on the lower ground nearby may be found, among others, the red or Canadian pine, from northeastern North America, the wood of which is largely used for building purposes and for masts, piles and spars; the small-flowered pine, another of the white pines and from Japan, where it is frequently used by the Japanese in producing their miniature trees; the Japanese black pine, also from Japan and useful for its wood; the Austrian pine, found native in Austria, Servia and Roumania, and the yellow, or bull, pine, from western North America.

In the triangle located midway between the south gate and the conservatories, are the American cypresses (*Taxodium*), in two species: the cypress, or bald cypress, and the pond cypress. These, like the larches (*Larix*), and a few other coniferous trees, shed their leaves for a portion of the year. They form vast areas, in parts of the southern states, called cypress swamps. Their timber is of economic importance and their bark is rich in tannin. None of the true cypresses (genus *Cupressus*) are hardy with us.

At the northern end of the swale in which the herbaceous grounds are located, and to the westward of the morphologic garden, is the collection of larches (*Larix*) and also the members of the yew family (Taxaceae). The larches are deciduous trees, the wood of which is of great economic

importance. Specimens of the European larch are here, and also of the Japanese larch. The genus *Pseudolarix*, distinguished from the larches in having the scales of the cones decidous, is represented by its single species, the golden or Chinese larch; this, like the true larches, is a deciduous tree.

The yew family (Taxaceae) is represented by three genera. Of the true yews (*Taxus*) there are: the American yew, or ground hemlock; the English yew and several of its horticultural varieties, the wood of which was highly prized in ancient times for the manufacture of bows; and the Japanese yew. The last is by far the best for this climate, standing well the dry summers and cold winters; there is a dwarf form of this known as variety *nana*, which is an especially desirable evergreen for decorative planting. The cluster-flowered yew (*Cephalotaxus*) is represented by the Japanese species and one other from Corea. The Japanese Torreya (*Tumion nuciferum*) represents this genus. Another species, *Tumion taxifolium*, of Florida, is not hardy in our climate; small plants of it will be found in house 12, conservatory range 1. Still other representatives of the yew family are in houses 12 and 13 of conservatory range 1.

To the north of the economic garden will be found specimens of the umbrella pine, not a true pine, however, but belonging to the genus *Sciadopitys*, a native of Japan. Another tree here is the Japanese cedar, *Cryptomeria japonica*, with several horticultural varieties. This will stand our winter climate only in sheltered situations such as this; the forms of the variety *Lobbii* are more hardy and are therefore better suited to this climate. There is also here a small specimen of the big tree of California, *Sequioa Washingtoniana*. This climate is most uncongenial to this noble plant which in its native country, the western slopes of the Sierra Nevadas, attains a height sometimes of over 300 feet.

On the westerly corner of the conservatory terrace and in

the immediate vicinity are located the retinisporas, which are so commonly cultivated as decorative plants. There are many horticultural forms here represented, but they are all variations of two Japanese trees: the Sawara cypress (*Chamaecyparis pisifera*); and the Hinoki cypress (*Chamaecyparis obtusa*). The latter species is frequently used by the Japanese in their dwarfing process. The names borne by the various horticultural forms have been suggested by some peculiarity in coloring or in manner of growth. North American species of the genus *Chamaecyparis* will be found in the low ground along the south walk, not far from the south gate.

On the easterly corner of the conservatory terrace, opposite the retinisporas, is a part of the juniper, or red cedar (*Juniperus*), collection. The remaining and larger portion of this collection will be found on the easterly end of the area lying between the driveway and the traffic-road south of the conservatories. In these two areas will be found many species and varieties of these plants. The common juniper, of north temperate regions, is one of these; also the Irish juniper, a form of this, of compact and strict habit. The red cedar, so common in a wild state in the grounds of the Garden, finds representatives in many horticultural forms. The savin juniper, of Europe and northern Asia, and its American representative, the prostrate or Waukegan juniper, of northern North America, are both neat low-growing sorts. The Chinese juniper, and its striking form, of columnar habit, known as variety *pyramidalis*, are each present in a number of specimens. There are still other varities of the Chinese juniper represented here, including *Pfitzeriana*, one of the best dwarf conifers.

At the westerly end of this area is the arbor vitae group (*Thuja*). The species of this genus produce a durable wood which is of especial value where there is contact with the soil. The Japanese arbor-vitae is represented by several specimens. The common arbor-vitae, or white cedar, from northeastern North America, is fully represented, not

only by the typical form, but by many horticultural varieties, some of them very decorative. The wood of this tree is valued for fence posts, railway ties, etc., and from its young branches fluid extracts and tinctures are made which are used in medicine. The Chinese arbor vitae, from China and Japan, has a number of specimens representing it and some of its horticultural forms.

The maiden-hair tree family is represented by a single species, the maiden-hair tree, several specimens of which may be found on the southern portion of the westerly ridge of the herbaceous grounds. This interesting tree, with its fan-shaped leaves, is a remarkable relic of a type of vegetation which was common and widely distributed in tertiary geological time, but is now restricted to eastern temperate Asia in this one species, *Ginkgo biloba*.

4. The Herbaceous Garden

The collection of hardy herbaceous plants is situated in a valley southeast of the public conservatories, and between the main driveway and the western border of the woods fringing the hemlock grove. This valley is about 1500 feet long and averages about 300 feet wide. A small stream runs through the valley from north to south and is here and there broadened out into pools. The collections are arranged in three series: (*a*) The systematic plantation; (*b*) the morphological garden; (*c*) the economic garden; the viticetum, or collection of vines, is planted at an arbor just east of the northern part of the valley.

(*a*) Systematic Plantation

This is located in that portion of the valley south of the driveway crossing it, and here the plants are grouped by natural families in botanical relationship. At the southern end are the seedless plants, represented by the ferns and their allies; east of the brook are the families of seed-bearing plants belonging to the large endogenous division, or those with parallel-veined leaves and with one seed-leaf (monocot-

VIEW IN THE HERBACEOUS GARDEN

yledons). To the west of the brook are the families belonging to the exogenous division of plants, or those in which the leaves are usually net-veined and which have two seed-leaves (dicotyledons); this latter group embraces the larger part of the plants in the collection. Along the brook, or in it, may be found many aquatic plants, representing in some cases families which are exclusively water-lovers, while in other cases they are aquatic representatives of families occurring in the immediate vicinity in the beds. In this plantation, the family groups are arranged substantially in a sequence beginning with those of simpler organization and proceeding to the most complex.

The series commences in the southern corner of the valley at the foot-path entrance, where the hardy ferns and their allies may be found, including species from all parts of the north temperate zone. Among these may be mentioned the ostrich fern, the cinnamon fern, Clayton's fern, the royal fern, the brake or bracken, and a number of species of the shield-ferns and of the spleen-worts. Some of the aquatic representatives of the ferns and their allies may be found in the pond nearby.

In this pond may also be found the following aquatic endogenous families: the cat-tail family, the bur-reed family, the pond-weed family, the arrow-grass family, and the tape-grass family. At the junction of the brook with this pond is the water-plantain family, including, besides the water-plantain, several species of arrow-head (*Sagittaria*). A little beyond, in the brook, may be found the water-poppy family, represented by the water-poppy, a showy plant common in tropical regions.

Following to the north comes the large group of the grasses and grass-like plants, those whose flowers, mostly very small, are subtended by chaffy scales or glumes. This is represented by the grasses and the sedges, several beds being devoted to each of these families. Some of the more familiar grasses are: timothy, Kentucky blue-grass, reed canary-grass, orchard grass, red-top and tall fescue-

grass, all used in making hay. Other grasses of interest are: sweet vernal-grass, exhaling a pleasant odor when bruised; the Japanese plume-grass, in several forms, very ornamental; the ribbon-grass, a variegated form of the reed canary-grass, and also ornamental; and species of many other genera.

The sedges are represented mainly by the large genus *Carex*, of which there are many species, native in the United States, growing in swamps, meadows and woodlands. Fraser's sedge (*Cymophyllus Fraseri*), is a striking plant from the southeastern United States, at one time one of the rarest of plants, but rediscovered in recent years in large quantities in the mountains of North Carolina. The tussock sedge, common in our swamps in early spring, the cat-tail sedge, Gray's sedge and the fox sedge, are others belonging to the genus *Carex*. There are also representatives of bullrushes and other sedges.

Following the sedges is the arum family, having as representative plants, familiar to many, the skunk cabbage, the green arrow-arum, the green dragon, the jack-in-the-pulpit, and the sweet flag. In the brook opposite to this family may be found the somewhat related duckweed family; the duckweeds (*Lemna*) are very common, these tiny plants sometimes occurring in such numbers as to cover the surface of ponds and slowly moving streams. Coming now to the spiderwort family, we have represented mainly the spiderworts and day-flowers. In a small pool and along its eastern edge is placed the pickerel-weed family. Here may be found a large clump of the pickerel-weed (*Pontederia*) which is common in swamps and along streams in the vicinity of New York; here may also be found the water-hyacinth, which has become such a pest in some of the rivers of Florida and the West Indies, and the closely related blue water-hyacinth, of more straggling habit, also of tropical origin, planted out in summer.

The rush family occurs next in the sequence, represented, among others, by such familiar plants as the common bog-

rush, the slender rush, and the common wood-rush. Following this come the members of the bunch-flower family, with several species of bellworts, the turkey-beard, the Japanese toad-lily, the fly poison, and others. Closely related to this is the lily family; one of the beds given over to this family is devoted to the true lilies (*Lilium*) in several forms; another is set aside for the onions and their relatives, of which there are many interesting forms, some of them of decorative value; while another bed is given to a miscellaneous collection of plants belonging to this family, among which may be mentioned the day or plantain lilies, the yellow day lilies and the lemon lilies, the true asphodel or king's sword, the grape-hyacinth and Adam's needle. Other close relatives of the lilies belong to the lily-of-the-valley family; here may be found many familiar plants, among them being the lily-of-the-valley (*Convallaria*), the wild spikenard, the common asparagus, of such wide use as a vegetable in the early part of the summer, and several species of the Solomon's-seal, both from the Old World and the New.

The amaryllis family is shown by a number of species of daffodils and narcissus. In the iris family, which comes next, many species are represented. Most familiar among these are: the common blue flag of our swamps, the yellow flag of Europe, the German iris, the Siberian iris, the Japanese iris and the blackberry lily. For the canna family reference is made to the plantations at the Garden fountain at the approach to the museum building and to the conservatories, and for orchids to the conservatories.

Crossing the brook now by the path paralleling the driveway, we come to the beginning of the sequence of the large series of plants with net-veined leaves and with two seed-leaves (dicotyledons). This series begins with the lizard's-tail family, represented here in the brook by the lizard's-tail (*Saururus*), a common plant of our brooks and river borders in the eastern United States. To the nettle family one bed is at present given, located near a group of magnolia trees,

where may be found, among other kinds: the slender nettle, of North America; the stinging nettle, native in Europe and Asia, but introduced into this country; and the wood nettle, also a North American plant; all of these secrete an oil through the hairs covering the stem and leaves, this oil being irritating to the skin, especially in the stinging nettle. In the immediate neighborhood and to the right is the birthwort family, represented by several species of wild ginger (*Asarum*), among them the common one of this region, the short-lobed wild ginger, the root of which is of medicinal value; another is Shuttleworth's wild ginger, of the southeastern United States. To the buckwheat family there are at present devoted three beds, forming a group to the left of the nettle family. The docks (*Rumex*) are shown in many forms, as are the knotweeds (*Polygonum*); the most showy of these are the Japanese and Sakhalin knotweeds, the latter a plant of considerable economic importance, being used as a fodder plant, and is a native of the Sakhalin Island; to this family also belong rhubarb, or pie-plant, and buckwheat. Next to this and near the brook is the goosefoot family, with several species, one of which, the lamb's-quarters (*Chenopodium*), is native of Europe and Asia, but found as a common weed in waste places and along roadsides in this country; its young shoots are sometimes used as a vegetable. Closely related to this, and just south of it, is the amaranth family, represented by several species of the pigweed, many of them among the commonest weeds of our roadsides and waste places. Forming a series to the right of this are: the whitlow-wort, four-o'clock, pokeweed, carpetweed and purslane families. In the whitlow-wort family are gnawel or German knotweed, a common weed of fields and waste places, and the forked chickweed. In the four-o'clock family may be found the common four-o'clock of our gardens, a native of tropical America, its flowers opening only on cloudy days or late in the afternoon on clear days, whence its name; and the umbrellaworts, from North America. In this vicinity is the Madeira-vine

family, to which belongs the genus *Basella*, here represented. The pokeweed family is represented by the common poke or garget (*Phytolacca*), native of the eastern part of North America, a plant of medicinal value and poisonous, but its young shoots when first appearing above the ground are sometimes used as "greens." In the carpetweed family are the carpetweed, from which the family derives its name, a native of the United States and Mexico, but a common weed in this vicinity; and representatives of the south African fig-marigolds (*Mesembryanthemum*), many of them very showy; they are not hardy in this latitude and must be planted out every spring. In the purslane family, among others, may be found the sunplant or common portulaca of the gardens, a native of South America; the small-flowered talinum, from the central United States; and the common purslane or pusly, a pernicious weed in many sections of the country, and often used for "greens" or as a salad.

Then comes the chickweed family, with sandworts, chickweeds and related plants. The pink family follows, where many kinds of pinks, catchflies, and gypsophils may be found. In the first pool, formed by the widening of the brook, is the water-lily family; the large yellow pond lily or spatterdock, a native of eastern North America, may be seen here, as may also its relative, the red-disked pond lily, from northeastern North America; the sweet-scented water-lily, and its variety, the pink, or Cape Cod, water-lily, also find a place here; the water-shield or water-target is also a member of this family and a native of North America. The tanks in the court of the public conservatories contain a great many additional kinds. The hornwort family likewise occupies a position in this pool. The aquatic members of the crowfoot family are grown here, the terrestrial forms being placed in four beds to the westward; one of these beds is given up entirely to the peonies (*Paeonia*), of which there are a number of interesting and handsome forms, and in the other beds may be found lark-

spurs, columbines, buttercups, meadow-rues, anemones, liver-leaf, and many other relatives; aconite, or monk's-hood, of great medicinal value, also belongs to this family.

The barberry family, which is represented by a single bed on the ridge to the right of the crowfoot family, contains, among others, the blue-cohosh and the may-apple or mandrake (*Podophyllum*), natives of North America; the twin-leaf, a native of the northeastern United States; and of Japanese plants, the red epimedium. In the poppy family may be found the oriental poppy, a native of Asia Minor and Persia, and here may be seen also the cordate *Macleaya*, from Japan, and the Mexican poppy, a native of Mexico and found as a weed in many tropical and warm temperate regions. In the fumitory family are the bleeding-hearts (*Bicuculla*), represented by the wild bleeding-heart from the eastern United States. The mustard family, which comes next in the sequence, occupies two beds. To this family belong the candy-tufts, represented here by the evergreen candy-tuft, from southern Europe and Asia Minor, and the alpine rock-cress, from Europe and North America, one of the showiest flowers in early spring, its mantle of pure white flowers making it a conspicious object; there are many other species represented in this group. The caper family has as representatives the showy pedicellaria, a native of the Old World, and the clammy weed (*Polanisia*), from northern North America. The white and yellow cut-leaved mignonettes (*Reseda*) represent the mignonette family. Across the path to the right, on the ridge and partly surrounding a rocky knoll, is the bed devoted to the orpine or stonecrop family, where there may be found many of the stonecrops (*Sedum*), among the more showy and attractive being: the great purple stonecrop, the great stonecrop, the white stonecrop, and the mossy stonecrop, all natives of Europe and northern Asia; the wild stonecrop from our own country; the Siberian stonecrop and the poplar-leaved stonecrop, both from Siberia; and a Japanese species, Siebold's stonecrop; also

belonging to this family are the houseleeks (*Sempervivum*), of which there are many representatives, all from the Old World, however, as these plants are not indigenous to the New World. Many other species of this family, not hardy in this latitude, may be found in the conservatories. Across the path from the orpine family may be found the three beds devoted to the saxifrage family. The heart-leaved saxifrage, with its large, thick leaves, from Siberia, is one of the showiest plants here, sending up its large masses of pink flowers early in the spring, so early sometimes that they are nipped by the frost. Among other plants here may be mentioned: the alum-root, from the eastern United States; the two-leaved bishop's-cap, from the northern United States; the Japanese plant, *Rodgersia;* and the shield-leaf saxifrage, from the western United States. Menzies' saxifrage, from western North America, is interesting from the fact that in late summer and fall it produces small plants at the base of the leaf-blades.

To the herbaceous members of the rose family are allotted five beds, located to the left of the saxifrage family. Many species of cinquefoils and agrimonies may be found here; of the strawberry (*Fragaria*) there are several species represented; the lady's-mantle, from north temperate regions, the various species of avens, the goat's-beard, the burnets and many others, are of decorative value or of interest for other reasons. The roses, blackberries and raspberries, also members of this family, are shrubs, and may be found at the fruticetum. The mimosa family has relatively few representatives in temperate regions, most of its numerous members being confined to warm temperate regions and to the tropics; many of these may be found in the conservatories. To the senna family belong the sennas or cassias, a showy representative being the American senna a native of North America; this family being also largely of warm temperate and tropical distribution, many other species may be found in the conservatories. To the right of the mimosa family may be found the bed devoted to the

pea family; to this some of our most valued economic plants belong, such as the pea, the bean and the clover; to the pea family belong also the baptisias, the bush-clovers, the vetches, the tick-trefoils and many other familiar plants.

Next in the order of sequence is the geranium family, to which belong the geraniums or crane's-bills; the plants so often cultivated in the house under the name of geraniums, but which are not hardy out of doors in our climate, are really not what they are called, but are truly pelargoniums, a closely-related group of plants belonging to the same family; our common wild geranium or crane's-bill may be found, among other plants here. A little farther on, near the brook, may be found the bed devoted to the wood-sorrel family, often called sour-grass by children; several species are shown here. Just to the left of the geranium family is the flax family, to which belongs the flax plant (*Linum*), from the fiber contained in the stem of which linen is made. Beyond this is the bed for the rue family; to this belong the common rue, of southern Europe, and the fraxinella; this family also includes the oranges and lemons, specimens of which may be found in the conservatories, and a very great number of tropical trees and shrubs. To the right of this is a small bed devoted to the milkwort family. The spurge family is in a bed just to the left of the flax family; the flowering spurge, from the eastern United States, and the cypress spurge, from Europe, but sometimes found wild in this country as an escaped plant, are both here. Along the edge of the brook, and opposite the spurge family, may be seen the water-starwort family, to which belong a number of small aquatic plants. About opposite this, and at the base of the rocky ridge to the right, are two representatives of the box family, in the trailing pachysandra, from North America, and its Japanese relative, the terminal pachysandra; the true box (*Buxus*) is a shrub or small tree, native of Europe, and several races of it may be found at the fruticetum. A little to the right of the wood-sorrel family is the jewel-weed

family, to which belong the common balsam of the gardens, and the plant so common along our brooks and other wet places, and known as jewel-weed, or touch-me-not. A little beyond this are three beds of the mallow family; the hollyhocks belong here, as do the mallows; the crimson-eye mallow and the swamp-rose mallow, both from North America, are showy representatives of this family; and the marsh mallow, a native of Europe and the Orient, is also shown; its root is used in the manufacture of a mucilage and for medicinal purposes.

To the right of the mallows is the bed given over to the St. John's-wort family. The rock-rose family comes next, a little further on; here belong the rock-roses of Europe and our own frost-weeds. To the right of this is the violet family; a collection of our native species, together with some from foreign lands, is here brought together and many of these may be recognized as old friends. Near the violet bed is one devoted to the loasa family. Up on the ridge to the right, across the walk, may be found the cactus family; relatively few of these are hardy in this climate, so the larger part of the cactus collection must be sought in the conservatories. Here may be found, however, several representatives of the prickly pears (*Opuntia*), including the eastern prickly pear, common in this part of the country which is frequently found on the rocky ridges in the vicinity of New York and occurs wild on some ledges within the Garden reservation. Down near the brook, and not far from the mallow family, is the loosestrife family, represented by the purple loosestrife, a native of Europe, but introduced in many places in this country; among others belonging to this family is the swamp loosestrife, or willow-herb (*Decodon*), a clump of which may be found along the brook opposite to the loosestrife bed. Near this, on the edge of the brook, is located the meadow beauty, one of the prettiest little flowers of our meadows; it belongs to the meadow beauty family, few species of which occur in coal regions; it is largely represented in warm temperate

and tropical regions, and many other species may be found in the conservatories. But a short distance from the violet family is the evening-primrose family; here may be found a number of the evening primroses (*Oenothera*), with their showy yellow flowers, noteworthy as the plants mainly experimented with by Professors DeVries and MacDougal in their studies on the origin of species. Along the brook, not far from the loosestrife family, is the water-milfoil family, represented by the Chilean water-milfoil or parrot's-feather, forming a beautiful mass of feathery green on the surface of the water. Returning now to the ridge, a little beyond the violet family, we find the bed allotted to the ginseng family; here are the Indian-root, from eastern North America, and the heart-leaved aralia from Japan. To this family also belongs the ginseng plant, the root of which is so much prized by the Chinese as a medicine. Down the slope from this group may be found two beds given over to the carrot family, which includes many economic plants, such as the carrot, parsnip, celery and caraway; lovage, a common European plant, is shown, and the rattlesnake-master, from the eastern United States; the wild carrot and the golden meadow parsnip also belong here.

To the primrose family, located at the base of the ridge a little beyond the carrot family, belong the primroses (*Primula*), many of which are natives of Europe; here we find the common European primrose, the cowslip and others; the moneywort, a native of Europe, but introduced into many places in this country, sends its long creeping stem all over the bed—this is sometimes known as creeping Charlie; the fringed loosestrife, from North America, is also here, as is the clethra-like loosestrife, from Japan, with its racemes of white flowers. Between the two beds devoted to the carrot family, and a little beyond, is the plumbago family, to which belongs the common thrift of Europe; there are several other thrifts here also, as well as the statices or sea-lavenders, in several species. The bed allotted to the

gentian family may be found a little beyond the plumbago family; various gentians are represented, among them the blind gentian, a native of the United States. In the brook, just beyond the little stone bridge, may be found the buck-bean family; here are shown the water-snowflake, common in tropical regions, and the water-lily floating heart, native in Europe and northern Asia.

Just beyond the left-hand bed devoted to the carrot family is the dogbane family; the willow-leaved amsonia, from the central and southeastern United States, and the broad-leaved amsonia, from the central and eastern United States, are conspicuous objects here. Beyond this are two beds of the milkweed family and among its representatives are the common milkweed of our roadsides, the hairy milkweed and the swamp milkweed; the swallowworts also belong here and are illustrated by several species. In the morning-glory family, located to the right of the above, are the small bind-weed, of northern Europe and Asia, sometimes a troublesome weed in this country, and the bush morning-glory from the western United States. Following the milkweeds is the phlox family; interesting plants here are the Jacob's-ladder (*Polemonium*), of Europe, with its masses of blue flowers; the hairy phlox, of North America; Brittons' phlox, a relative of the common ground phlox, from the southeastern United States; the ground phlox and its white-flowered form, both natives of the eastern United States; and forms of the garden phlox, also from the southeastern United States. In the shade, the natural habitat of many of these plants, is the water-leaf family, at the base of a large rock on the ridge; there are the purple, the broad-leaved and the Virginia water-leaf (*Hydrophyllum*).

Further along and at the base of the ridge is the borage family; the tuberous comfrey, the rough comfrey and the common comfrey, all natives of Europe, are represented. In the vervain family, in a small bed to the left, may be found: the wedge-leaved fog-fruit (*Lippia*), from the wes-

tern United States and Mexico and the vervains. We now come in the sequence to the mint family, to which are devoted six beds; among the true mints may be found here the creeping whorled mint, the curled mint and the spear-mint, all from the Old World. Many familiar plants may be seen in these beds, and among them are: the false dragon-head, of the United States; motherwort, common in Europe and widely distributed as a weed in this country along roadsides and in waste places; the horse-balm, of North America, common in the east in woods; Oswego tea, and other bergamots, natives of North America; the betony and hyssop, of Europe; the hedge-nettles, from both the Old World and the New; the common sage of the Mediterranean region, highly prized by the housewife, and other sages; catnip, a native of Europe, but widely distributed as a weed in this country; Gill-over-the-ground, or ground ivy, also a European plant, but extensively spread as a weed in this country; and the dittany, of North America.

The potato family may be found a little to the left and just beyond the phlox family. Here may be seen the common jimson, or Jamestown, weed, the seeds of which are poisonous, a native of tropical regions, but a common weed along our roadsides; the nightshade, a European plant, but commonly distributed as an introduction in many parts of this country, also with poisonous fruit, tobacco plants and solanums; it is to this family that the potato, tomato and egg-plant belong. A little beyond and to the left of the mints are the two beds allotted to the figwort family; of interest here are: the beard-tongues, of which there are several species; the speedwells (*Veronica*), among them the long-leaved speedwell and the gentian speedwell; the fox-gloves (*Digitalis*), from one of which, the purple fox-glove, the valuable medicine digitalin is derived; Lyon's snake-head from the southern states; culver's-root, from the southeastern United States; and several figworts. Just beyond this may be found the

unicorn-plant family, represented by the unicorn-plant. A little beyond is the globularia family, presented by a single species of globularia. To the right is the acanthus family; not many of these plants are hardy in this latitude, but in the conservatories many representatives may be found, as the family is largely confined to tropical and warm temperate areas; in this bed may be seen the hairy ruellia, from the southeastern United States. In this neighborhood may also be seen the lopseed family, represented by the lopseed, a native of eastern North America.

To the right of the acanthus family is the single bed devoted to the plantain family; several species, such as Rugel's plantain and rib-grass, are pernicious weeds in this neighborhood, often disfiguring an otherwise even lawn. Just beyond the mints may be found the two beds of the madder family; to this belongs the dainty little bluets or innocence, which sometimes give a blue sheen to sterile, sandy places, so abundant is it in some localities; it is quite common in eastern North America; several species of bedstraw (*Galium*) may also be found here, while many other plants belonging to this family are grown at the conservatories, among them the coffee tree. A little beyond is the single bed of the honeysuckle family, represented by the feverworts; this family being largely composed of woody plants, many other species, including the true honeysuckles, may be found in the fruticetum and in the viticetum. To the left is the valerian family with a single bed; here may be found the valerian, a common European plant.

Just beyond the plantain family is the teasel family. It is to this that the teasel plant belongs, used in olden times for raising the nap on woolen cloth. Several species of cephalaria may be found here. Next in sequence is the gourd family, to which belong such common fruits as the cucumber, muskmelon, watermelon and pumpkin. The bell-flower family is a little further on and to the left of the teasel family; the Carpathian and Host's bell-flowers, both

natives of Europe, are pretty representatives here; the creeping bell-flower, or Canterbury bells, also a native of Europe, may be found here in several forms; the Japanese bell-flower and its white variety are also here, their large showy flowers making them quite conspicuous. A little further on and to the left is the lobelia family; the cardinal flower and the great lobelia, both natives of North America, make showy objects; the former is particularly striking in its rich masses of cardinal-red flowers.

To the right of the teasel family is the chicory family. The common lettuce (*Lactuca*), so much used in salads, belongs here; many of the plants are extremely weedy by nature, and this is particularly true of the hawkweeds, a genus richly represented in the Old World, several species of which are shown here; the oyster plant is also a member of this family.

To the left of this may be found the ragweed family. All the species here are of a weedy nature. The ragweed, the giant ragweed and the common clot-blur find representation here. Terminating the sequence comes the very large thistle family, represented by many species from all parts of the world; there are nine beds at present given over to these plants; the sunflowers, coneflowers, thistles, asters, fleabanes, yarrows, golden-rods, tansies, sneezeweeds, burdocks, artemisias and wormwoods, cat's-foot, tick-seeds, elecampane, boneset, chrysanthemums, colt's-foot and many others are shown; the Jerusalem artichoke, one of the sun-flowers, a native of eastern North America, bears edible tubers.

Herbaceous Garden Pergola

A small, hexagonal, concrete pergola stands in a triangle formed by three paths in the forest edge on the eastern side of this plantation.

(*b*) Morphological Garden

This is located to the north of the systematic collection, the two collections being separated by the driveway which

crosses the valley. It is designed to illustrate here with typical examples the organs and other features of plants, including leaf-forms and the various modifications of their margins, their venation and insertion on the stem; also the various kinds of stems, methods of propagation, flower-clusters and fruits, leaf-movements, parasites, desert plants and seed-dispersal. Looking north on this collection, the first bed to the right of the brook contains plants illustrating simple leaf-forms. Immediately following this on the same side of the brook are the plants representing the various forms of compound leaves, or those in which there is a distinct jointing of the leaflets to the leaf-axis. Farther along the brook, in the pool, may be found various forms of aquatic roots, stems and leaves; and a little beyond this to the right is the bed containing plants illustrating forms of propagation.

The remaining plots of this collection are located on the left hand or westerly side of the brook. The first of these to the right is devoted to leaf-venation, and the one to the left to leaf-margins, the former illustrating the character of the veins and nerves, and the latter the toothing or lobing of the margins. Beyond this to the right is the group of plants showing the manner of insertion of the leaves on the stem; and to the left of this are specimens illustrating the various ways in which plants may form a mosaic covering on the ground. A little beyond are the examples of stem-forms; one bed is devoted to show the smaller kinds, while for the larger examples, illustrating tree-twining, root-climbing and tendril-climbing stems, specimens have been placed to the left of this bed.

A little beyond the pool may be found the bed illustrating flower-clusters, and still further on that devoted to parasitic plants, or those deriving their nourishment from the living tissues of other plants. To the left of this and farther up the hill is the group of plants showing leaf-positions. Beyond and a little to the right are plants which are at home in desert regions, and the various means of accom-

modating themselves to their natural surroundings are shown. Further on to the right is the bed devoted to fruit-forms; and to the left of this, one showing various forms of seed-dispersal; those with the surface of the fruits covered with some sticky substance or curved appendages or hooked hairs or spines require the intervention of some animal for their distribution, while those with wings or with hairs attached to the seed are spread through the agency of the wind. To the right of the above are plants representing a species and a variety, and to the left of this is a bed containing plants showing species and hybrids. Another bed in this vicinity illustrates mutations.

(*c*) Economic Garden

The collections illustrating food plants and those producing substances directly useful to man in the arts, sciences and industries are planted at the northern end of the long glade containing the herbaceous collections just described. The collection is arranged in two series divided by a central grass walk. The beds on each side are numbered consecutively, the number being indicated on a wooden stake in the center. A general sign is placed in each of the beds, denoting what its contents are intended to represent, and in front of each plant is a smaller label giving individual information.

On the east side of a broad central grass path and the brook are located plants used for medicine, those employed as condiments or relishes, and a number of plants from which the fiber is used in the manufacture of various fabrics. The medicinal plants which grow in wet or moist situations may be found on the easterly side of the brook. Along the westerly border is also a collection of medicinal shrubs and trees.

On the west side of the grass path and brook are the food plants. Here may be found many of the common fruits and vegetables. Along the gravel path is a collection of shrubs and trees, containing some of the more common plants producing edible nuts and fruits.

In the eastern series, bed no. 1, located at the northern end, contains plants used as condiments and relishes; here, among others, are peppermint, spearmint, mustard, lovage, lavender, savory, caraway, dill, coriander, basil, marjoram, anise, balm, sage, tarragon, and horse-radish. Beds 2, 3, 4, 6, and 7 contain drug plants. In beds 2, 4, and 6 it is the roots and rootstocks which are employed; such drugs as valerian, Indian physic, convallaria, sanguinaria, podophyllum or mandrake, inula, belladonna, pleurisy-root, rhubarb, cimicifuga, arum, tussilago or coltsfoot, and caulophyllum are here. In bed 3 among the commonly known drugs are catnip, tansy, horehound, and stramonium, the leaves of which furnish the active principles. In bed 7 are plants from the herbage, seeds or flowers of which drugs are manufactured; hops, tussilago or coltsfoot, rue, tobacco, castor-oil, digitalis and dulcamara are some of these. Bed 5 contains plants from which fibers are obtained, such as cotton, flax, used in the manufacture of linen, hemp, and broom-corn, from the inflorescences of which brooms are made. In the adjoining woodland border of shrubs and trees are the prickly ash, barberry, witch hazel, cramp-bark, rhamnus, frangula, euonymus, red-root, shrub yellow-root, and hydrangea. Along the east side of the brook will be found calamus and magnolia.

In the western series, devoted to food plants, in bed no. 1, located at the north end of the first line of beds, are plants the bulbs of which are useful for ood; among these are onions, garlic, chives, and leeks. In the adjoining bed 10, the first of the second line, are those furnishing tubers for food, such as the sweet-potato, Irish potato, and Jerusalem artichoke. In bed 18, the first in the third line, are plants with fleshy roots, such as celeriac, oyster-plant, radishes, turnips, carrots, and beets. In beds 2 and 3 it is the leaves which are edible; familiar examples are cabbage, kale, lettuce, Brussel's-sprouts, collards, chicory, Chinese mustard, fetticus, endives, and spinach. In bed 4 are plants, the herbage of which is used; examples here are French

spinach or orach, and rocket salad or roquette. It is the stems and leaf-stalks of the plants in bed 11 which are edible; here are asparagus, rhubarb, sea kale, kohlrabi, cardoon, and celery. In bed 5 are cauliflower and broccoli, the flowers being the edible portions.

Many plants furnish food in the shape of fruits. A fruit is developed from the flower, thus differing from a vegetable which is the edible portion of some part of a plant other than the fruit. Beds 6 to 8, 12 to 16, and 19 to 27 contain plants which furnish edible fruits. These divide themselves generally into two kinds, those in which the fruit is more or less fleshy, such as berries, pumpkins and beans, and those in which the seeds only furnish the food value, such as wheat, barley and other grains. In bed 6 are the egg-plant and okra. In bed 8 will be found peas, beans, and fennugreek; in bed 12 the various kinds of tomatoes; in bed 13 the different sorts of peppers; in bed 14 strawberries; beds 19 to 26 contain each a single kind, as follows: crookneck squash, pumpkin, musk melon, citron, water melon, Hubbard squash, English marrow, and cucumber.

In the group containing the grains are the four common cereals, wheat, rye, oats and barley, all in bed 7. In bed 15 are the different kinds of sweet corn. In bed 16 are the field corns, both flint and dent, and popcorn. In bed 27 are buckwheat, sorghum, and rape, among others.

Beds 9 and 17 contain fodder plants. Bed 9 has fodder plants other than grasses, such as alfalfa, red, white and crimson clovers, winter vetch, summer vetch, yellow lupine, blue lupine, and Florida beggarweed. In bed 17 are fodder plants of the grass family, such as teosinte, Johnson grass, field corn, timothy, Kentucky blue- grass, red-top, and pearl millet. In bed 28 is the sugar-cane plant, from the juice of which sugar, one of the most important articles of food, is made.

In the border of woody plants along the gravel walk are such familiar fruits as the hazel-nut, black, red and white currents, gooseberry, blackberry, black-cap, elderberry,

chinquapin, barberry, huckleberry, and highbush blueberry. Along the west side of the brook will be found rice, which furnishes the principle article of food for millions of people, especially in the tropics of the Old World; the cranberry plant; taro, also an important article of food in the tropics, largely taking the place there of the potato in temperate climates; and water-cress.

Viticetum

The area devoted to the plantation of hardy vines is above the easterly side of the economic garden, where a rough arbor has been constructed for them to climb upon. The arrangement begins at the southerly end of the arbor, on the left hand side, with the smilax family, to which belong the green-briers or cat-briers. The yam family is placed immediately opposite to the right, followed by the mulberry family on the same side. The birthwort family, with the dutchman's-pipe as a representative, follows the smilax family on the left, and opposite to this is placed the buckwheat family, to which belong the climbing bindweeds and brunnichia. On the left hand side, and beyond the birchwort family, is the akebia family, where one may find the five-leaved akebia, a native of Japan. Following this on the same side is the moonseed family, to which belongs the Canada moonseed. On the opposite side of the arbor is the hydrangea family. Following this, also on both sides of the arbor, is the pea family, including species of the peas and wistarias. Further on, occupying both sides, is the staff-tree family, where may be found the climbing bitter-sweet and other vines of this family. Succeeding this comes the grape family, to which belong the grapes, the Virginia creeper and the Japanese ivy. On the right, beyond the grape family, is the actinidia family, represented by the toothed actinidia. Then comes the trumpet-creeper family, of which the trumpet-creeper, a native of the southeastern United States, is a member. This family in turn is followed by

the honeysuckle family, represented here by several species of honeysuckle and woodbine.

5. The Fruticetum

[COLLECTION OF SHRUBS]

This plantation, occupying about 16 acres, is located to the northward of the lakes in the rear of the museum building, and is confined to the area lying between the lakes,the railroad, the woodland on the east, and the north meadows. In this collection are brought together specimens of hardy woody plants which are shrubs, that is, plants with woody stems which branch from the ground and have no single main stem. The arrangement here parallels that in the herbaceous grounds and in the other systematic collections. The sequence begins on the southerly side near the long stone bridge which crosses the Bronx River, and proceeds on both sides of the path running to the north along the edge of the woods, returning southward on both sides of the path paralleling the main north and south driveway, to the plum family, on the bank overlooking the water garden. It then crosses to the senna family directly opposite and overlooking the westerly lake, proceeding northward from there across the transverse driveway, and following the line of the path paralleling to the westward the main north and south driveway. The sequence then continues to the westward along the north path, again extending southward at the Woodlawn Road entrance, continuing on both sides of the westerly path and terminating with the thistle family at the westerly end of the lake near the railroad border. The families will be referred to below in this sequence. Woody vines are grown at the viticetum.

The pine family, represented by some of the low-growing junipers and pines, begins the sequence to the southward of the approach to the long bridge. The next is the willow family, beginning across the road from the pine family;

WOODLAWN ROAD ENTRANCE, FRUTICETUM

this group is located on both sides of the path and comprises many forms from various parts of the world; the family is largely an inhabitant of temperate regions, so many species can be grown here. The bayberry family occurs across the driveway from the willows, occupying a position on the bank overlooking the water garden. Here may be found the sweet-fern, a native of eastern North America; the sweet gale, at home in north temperate regions; and the waxberry or bayberry, common in eastern North America; the berries of the latter have a covering of wax, which was separated by throwing the berries into hot water, when the wax melted and rose to the surface, where it was skimmed off; it is still used to some extent in making candles. The monotypic corkwood family is represented by the corkwood (*Leitneria*) of the southern United States, which has proven to be hardy here at the foot of the terrace, its catkins flowering early in the spring. The birch family follows the willows on the east side of the path; here are the hazel-nuts, the alders and the shrubby birches; the common hazel-nut and the beaked hazel-nut, both from North America, also the common hazel-nut or filbert of Europe, and others; the smooth alder, common along streams and in swamps, is also here. Following the birch family on the same side of the path comes the beech family; here may be found the shrubby oaks and the chinquapin of the southeastern United States. On the same side of the path, a little farther along, is the elm family, represented by the dwarf elms; most of the members of this family are trees and may therefore be found in the arboretum. Immediately following this is the mulberry family, represented here by specimens of the Tartarian mulberry.

The crowfoot family occupies a space just to the north of the willows west of the path, and is represented by the moutan or tree peony, from China, and the shrub yellow-root (*Xanthorrhiza*), from the eastern United States; its roots are yellow, and at one time were employed as a dye;

there are many herbaceous members of this family at the herbaceous grounds. The barberry family is a little farther north on the same side of the path; many species of barberries and mahonias occur here. Among the barberries may be mentioned: the common European barberry, the ripe fruit of which is sometimes made into preserves, and the unripe ones pickled as a substitute for capers—its bark is used as a dye and for tanning leather; Thunberg's barberry, from Japan, a desirable plant for small hedges and for the borders of walks; the neat barberry, from the Himalayan region, which colors a beautiful red in the fall; and the large-toothed barberry, from Nepal; the mahonias are represented by the erect Oregon grape, from northwestern North America; and the Japanese mahonia. The magnolia family occurs a little back from the path, between the crowfoot and barberry families; there are here several species of shrubby magnolias. The strawberry-shrub family is located on the point dividing the paths, opposite the mulberries already referred to; here may be found several species of the strawberry-shrub, including the hairy one which has the fragrant flowers scented like the strawberry, the fragrant *Chimonanthus*, from Japan, is a member of this family, and is known to the natives there as karamume. A short distance to the north of the strawberry-shrub family is the laurel family, represented by the spice-bush (*Benzoin*), a native of northeastern North America; as the different kinds of flowers, staminate and pistillate, are borne on different plants, only those having pistillate flowers bear the bright red berries in the summer and autumn. In the lower land below, to the east of the path, is the Virginia willow family, with shrubs of the Virginia willow, a native of the southeastern United States. Across the path from this is the hydrangea family; here may be found the syringas, the deutzias and the hydrangeas, several species of each; the mock orange (*Philadelphus*), a native of Europe, indicates its presence by the rich frangance of its flowers; the slender deutzia, from

Japan, bears its long slender clusters of white flowers in great profusion; the large-flowered hydrangea, a Japanese-plant, bears a profusion of large bunches of white flowers, which in the late summer and autumn change to a beautiful rose color; the oak-leaved hydrangea is perhaps the oddest member of this genus; it is native from Georgia and Florida to Mississippi. Following the hydrangea family comes the gooseberry family, and to this belong the currants and gooseberries; one of the showiest is the long-flowered golden currant, from western North America; its rich yellow flowers give forth a delicious spicy fragrance. The witch-hazel family is located to the north of the north path and on the point opposite; here is the common witch-hazel, of eastern North America, from which the extract of witch-hazel, or Pond's extract, is made, the Japanese witch-hazel, and also a Chinese representative of this genus; the spiked corylopsis, a Japanese shrub, belongs here, as do the fothergillas of the southeastern United States.

The rose family occupies a large area, beginning just north of the gooseberries and currants and extending westward to the main north and south driveway, and southward along that as far as the first transverse path; here belong the spiraeas, of which there are many forms, the blackberries, the raspberries, the roses and others. Among the spiraeas, the steeple-bush or hard-hack and the willow-leaved meadow-sweet, or quaker-lady, are common as wild plants in this latitude. Other interesting forms are Thunberg's spiraea, from Japan, and other Japanese spiraeas. Among other plants of interest in the group which contains the spiraeas are the Chinese pearl-bush, a native of northern China, with its profusion of white flowers in early summer; the Japanese rose, from Japan, not a true rose, however, with bright yellow flowers; another shrub from Japan, known to the natives of that country as siro yama buki, bears large white flowers resembling in appearance those of the mock orange; two other Japanese shrubs, members of the same genus, and

known to the natives there as kago ma utsugi and yama doosin, respectively, the former an exceptionally graceful and attractive plant; *Neviusia*, an extremely local plant, known in a wild state only in Alabama; and the nine-bark, of eastern North America. To the southward of the spiraea group comes the collection of blackberries and raspberries (*Rubus*) represented by many kinds; two of the showiest are the Japanese wineberry and the purple flowering-raspberry, the latter common in rocky woods in this part of the country. Farther to the south is the group of the true roses; many kinds may be found here, including the sweet-brier, the dog-rose, or wild brier, and the red-leaved rose, all natives of Europe; the low or pasture rose of eastern North America; and the odd-looking Watson's rose, a native of Japan. Numerous herbaceous species of the rose family are grown at the herbaceous grounds.

Following this is the apple family; to this belong the apples and pears, many of which, being trees, may be found in the arboretum. Of a shrubby habit, and therefore members of this collection, are many of the hawthorns or thorn-apples, the quinces, the rose-boxes, the choke-berries, the service-berry and the shad-bush. Southward across the driveway from these, and overlooking the easterly lake, is the collection illustrating the plum family, to which belong the plums, cherries, apricots and peaches. As many of the species of this family are trees they may be found at the arboretum. Among those represented here are the western sand cherry, of northwestern North America; the three-lobed peach, a native of China, in its double-flowered form; the dwarf peach, from Europe; and the Russian almond, of Russia and western Asia.

Crossing the driveway to the west, the sequence is again taken up on the ground overlooking the west lake, with the senna family, represented by the Asiatic Judas-tree, of China and Japan, and the American Judas-tree of the eastern United States; in spring, before the appearance of the leaves, these are profusely covered with pink or pur-

plish flowers. Across the transverse driveway to the north, and directly on the opposite side, may be found the pea family. Here are various species of the pea-tree: the pigmy pea-tree, from the Himalayan region; the Chamlagu pea-tree, from China; the common pea-tree and the small-leaved pea-tree, both from Siberia. The white broom, the common broom and the dense-flowered broom all of Europe, have representatives here; of these, the common broom, in Spain and France attains the size of a small tree, and its wood is highly prized for veneering and cabinet work; its branches are extensively employed for making brooms, whence its common name. Other plants of interest are the false indigo and the bristly locust and Kelsey's locust, all from the southeastern United States; the woody bladder-senna, from Europe and the Orient; and the scorpion senna, from southern Europe. Immediately beyond is the rue family, illustrated by the shrubby trefoil (*Ptelea trifoliata*) of the eastern United States; the prickly ash, from the northeastern United States, and Bunge's prickly ash, from China, and the anise pepper tree, of the same genus, from China and Japan; and the trifoliolate orange, from Japan, which has been used as one of the parents in the recent hybridization experiments by the U. S. Department of Agriculture in its effort to produce a more hardy orange; the lemon and forms of the orange may be found in the conservatories, together with other woody members of this family. The tanners'-tree family comes next with a single representative from Japan. Following this is the box family, represented by a number of forms of the box-tree, from Europe, Asia and Japan; the wood of the box-tree is highly prized for wood-engraving, on account of its hardness and close fine grain, and it takes a fine polish. A few steps further on is the sumac family, to which belongs the common poison ivy, so frequent in and around New York City; here are the fragrant sumac, the mountain sumac and the smooth or scarlet sumac, all from the eastern United States; Osbeck's sumac is a stately shrub from

China. The European and the American smoke-trees (*Cotinus*) are relatives of the sumacs; the former is sometimes called the wig-tree, on account of the flower-clusters which become white and feathery in fruit; a dye is obtained from it which is called young fustic.

Crossing the transverse path to the triangle, the holly family is on the nearest point, shown by the serrate holly and the crenate holly, both from Japan, and the American holly; the European holly is grown in the conservatories. The Virginia winter-berry, of the eastern United States, bears its bright red berries far into the winter. On the opposite corner of the triangle is the staff-tree family, illustrated by many forms of *Euonymus;* the European staff-tree, the burning-bush of the eastern United States, the winged spindle-tree of eastern Asia and Bunge's spindle-tree of the Amur region are shown. *Pachistima Myrsinites*, from the northwestern United States, is also represented. Crossing the path to the north of the triangle we come to the maple family; most of the maples are trees, so they must be looked for in the arboretum, but here are specimens of the Ginnala maple, from northern China and Japan. Immediately beyond this is the bladder-nut family, represented by species of the bladder-nut (*Staphylea*), both from the New and the Old World. Following the path to the west, we come to the buckeye family, represented here by the small-flowered buckeye, from the southeastern United States; many of the buckeyes and horse-chestnuts are trees, and are grown in the arboretum. Following this is the soapberry family, with the genus *Xanthoceras*, a native of China, as a representative. At some distance from the path to the left is the buckthorn family; the most familiar plant here is the New Jersey tea, or red root, of eastern North America; its leaves were formerly used as a substitute for tea; the jujube-tree, an inhabitant of the Mediterranean region and temperate Asia, is of this family, its edible fruit oval in shape and about the size of a plum, with an acid taste when fresh; the

Dahurian buckthorn, growing wild from central Asia to the Amur region, and the purging buckthorn of Europe, the berries of which are medicinal, are here; from the juice of the ripe fresh berries of the purging buckthorn, mixed with alum, is made the pigment, known as sap-green or bladder green, used by water-color artists. Close to this is the linden family, represented by the genus *Grewia*. The mallow family, further along the path, is represented by specimens of the rose-of-Sharon (*Hibiscus syriacus*), from western Asia, and often found escaped from cultivation in the eastern United States; many herbaceous representatives of this family may be found at the herbaceous grounds. Near the mallow family is the tea family, represented by the mountain *Stuartia*, from the southeastern United States; other members of the tea family, including the tea plant and the common camellia, may be found in the conservatories. Also near the mallows may be found the St. John's-wort shrubs (*Hypericum*), with their showy yellow flowers. Farther on, where the path bends to the left, is the tamarix family, represented by several species of tamarix, Old World plants. Next comes the mezereon family, having as a representative the leather-wood or moose-wood (*Dirca*), of the eastern parts of North America; the name leather-wood refers to the very tough inner bark; the bark is a violent emetic; the daphnes are of this family, and here will be found the garland-flower, the spurge flax, and the Chinese daphne.

Some distance from the path and opposite the Woodlawn Road entrance, is the oleaster family, including several species of oleaster, the buffalo berry and the sea-buckthorn, a native of Europe, the berries of which are acrid and poisonous; the berries of several of the species of oleaster are edible; the buffalo berry, of northwestern North America, is largely eaten by the Indians of that region; the berries of the oriental oleaster, known as Trebizond dates, are made into cakes by the Arabs, after having been dried. Plants of the ginseng family form a group opposite the

same entrance, some of these being quite tropical in aspect; the Japanese angelica-tree, from Japan, is one of these, and another is Maximowicz's acanthopanax, also from Japan; the variegated Chinese angelica-tree, a native of China, is quite ornamental. Beyond this group, and on both sides of the transverse path, is the dogwood family, shown by many species of dogwood or cornel (*Cornus*), from both the Old World and the New; the red-osier dogwood, the kinnikinnik and the panicled dogwood are American representatives; the officinal dogwood comes from Japan and is known there as sandzaki; the dogberry, gater-tree, or hound's-tree, is from Europe and western Asia; its wood is hard and is sometimes made into butchers' skewers and tooth-picks; in France, an oil used for burning and in soap-making is extracted from the black berries. *Benthamia Kousa*, the Japanese flowering dogwood, from China and Japan, is shown in a number of specimens; this is related to our native flowering dogwood, *Cynoxylon floridum*.

Across the path from the dogwoods, at the foot of the steps, may be found the white-alder family. Here are the Japanese sweet-pepper bush and the North American sweet-pepper bushes or white-alders, their fragrant white flowers appearing in August. The heath family is next, represented by many forms of azaleas and rhododendrons; the Japanese *Pieris* is a pretty plant, and another of a related genus, from the southeastern United States, is called mountain fetter-bush; the stagger-bush, of the southeastern United States, is also here. Following the path to the south, we come next to the huckleberries and to the shrubs of the storax family. On the other side of the path is the olive family, which covers a large area, extending along the path for a considerable distance; the olive-tree is the type of this family, and specimens may be found at the conservatories; in the fruticetum are several forms of the golden-bell (*Forsythia*), from China; a number of the privets, including the California privet, so much used for

VIEW IN THE FRUTICETUM, OR SHRUB COLLECTION

hedges; a variety of lilacs (*Syringa*), including the Rouen lilac, from China, the Pekin lilac, from southern China, the Himalayan lilac and the common lilac, a native of eastern Europe, so frequently cultivated in gardens, and the *Forestieras*. To the right of the path and following the storax family is the logania family, with species of *Buddleia*, including the showy variable buddleia, from China. Following this is the vervain family, and some of these shrubs are especially attractive in fruit, among them being the purple callicarpa, from China, and the Japanese callicarpa; most attractive is the late-flowering clerodendron, a Chinese plant, whose flowers have a delicious spicy fragrance, much like that of the sweet-pepper bush; the sepals are a beautiful rose color, while the corolla is creamy white; it blooms late in the summer or early fall, when flowers of shrubs are few.

We next come to the potato family, shown here by the matrimony vine, a native of Europe, but often found growing wild, its purple flowers followed by bright red berries; most of the hardy representatives of this family are herbs, so must be sought for in the herbaceous grounds, while many of the woody species, and some of the herbs, are tender, and may be found in the conservatories. The figwort family is shown in a single representative from the northwestern United States, *Pentstemon Scouleri;* many other representatives of this family are in the herbaceous grounds and the conservatories. The succeeding group is the honeysuckle family, to which is allotted a large area, there being many hardy kinds; the viburnums are represented by many species, both from the Old World and the New, such as the cranberry-tree, from north temperate regions, ornamental by its masses of bright red fruit; the dwarf cranberry-tree, an exceedingly compact form, very dense in its growth; the Chinese viburnum, from China and Japan; Siebold's viburnum, from Japan; the Japanese snowball, from China and Japan; the wayfaring tree, from Europe and Asia; and the woolly viburnum, from China and

Japan; among American forms may be mentioned the arrow-wood, Canby's arrow-wood, the black haw or sloe, the withe-rod, and the larger withe-rod with its large bunches of showy fruit. The group of the honeysuckles occupies a position across the path from the viburnums, and here may be found, among others, the fragrant honeysuckle, from China, one of the first to send forth its blossoms richly laden with perfume; Morrow's honeysuckle, from Japan, covered with coral-red fruit in late summer and fall; Standish's honeysuckle, from China; the narrow-leaved Albert honeysuckle, from Turkestan; the blue fly-honeysuckle, from north temperate regions; and the golden-veined honeysuckle, from China and Japan, with the veins richly marked with yellow, or sometimes the whole leaf yellow. Across the transverse path to the south, and overlooking the lake, may be found the weigelas, symphoricarpos and the diervillas; the weigelas are illustrated by many showy forms, flowering in early summer; the showiest *Symphoricarpos* is the snowberry, native of northern North America, laden in autumn with its ivory-white fruit, making it most attractive; the diervillas are represented by two or three species, including the bush honeysuckle, a native of northern North America. The elder-berries (*Sambucus*) are also represented by two or three species. The hybrid abelia will also be found here; its fragrant flowers are borne in great profusion during late summer and early fall; the sepals are deep red-brown and the corolla is white, flushed with rose, making a pleasing combination.

Following the viburnums comes the thistle family. Few of the woody species of this family are hardy in this latitude, but large numbers of the herbaceous species may be found at the herbaceous grounds. As representatives in the fruticetum, we have the groundsel-bush or pencil-tree (*Baccharis*), a native of the southeastern United States, bearing in the fall a profusion of white fruit, making it a most attractive object; and some of the shrubby wormwoods (*Artemisia*) of the Old World.

VIEW IN THE DECIDUOUS ARBORETUM.

Salicetum.—The area occupied by this plantation is between the main driveway and the Bronx River, north of the fruticetum, and comprises several acres. Here are brought together moisture-loving willows (*Salix*) and poplars (*Populus*) as a collection apart, many species grown here not being represented in the arboretum and fruticetum. In the corner of the salicetum, next to the driveway, is a group of willows, consisting, in part, of the red-stemmed yellow willow, of horticultural origin, and the Ural purple willow. To the east of this may be found the golden, or yellow willow, of common occurrence in eastern North America, and Bashford's willow, a native of France. Along the west bank of the Bronx River may be found the cottonwood, or Carolina poplar, found wild in eastern North America; and a row of the weeping willow, a native of Asia. At the northern end of the area devoted to this plantation are to be found, among others, the purple willow, a native of Europe; and the black willow, of North America. Many other species are represented in this collection.

6. The Deciduous Arboretum

This plantation extends over much of the garden area east of the Bronx River. The sequence of plant families begins at the southeast corner of the grounds and continues northward to the northern boundary, occupying the easterly ridge and the low grounds adjacent thereto. Here hardy trees are brought together, trees being regarded as woody plants which have a single main stem arising from the ground and not branching until some distance above it. The groups will be referred to in the order of their sequence.

The first is the willow family which occupies the land near the south border, where a collection of willows and poplars may be found. Of these Simon's poplar, from China, is of rapid growth and upright habit, and more graceful than the cottonwood or Carolina poplar; the American aspen, a native of northern North America, the wood of which is largely manufactured into pulp

for the making of paper; in northern British America it is the principal fuel of the Indians, as it burns freely when green and without sparks; the inner bark, which is sweet, is often used by them as a food in early spring. This tree has been of great service in re-foresting large tracts which have been denuded by fire; the long hairy appendages to the seeds enable the wind to carry them far and wide, and as they germinate quickly and the young seedlings grow rapidly in exposed situations, it is admirably adapted to the above purpose, quickly furnishing a covering for the land until more desirable trees may get a foothold. The white or silver-leaf poplar, of Europe and Asia, and Bolle's poplar, a variety of this with lobed leaves and quite ornamental, are here. Another ornamental tree and one frequently used where quick growth is desired, is the eastern cottonwood, or Carolina poplar, common in eastern North America. There also is the Lombardy, or Italian poplar, from Europe and Asia, with its tall spire-like growth. Among the willows are the white willow, from Europe, and the weeping willow, native of Asia, a tree commonly planted for ornamental purposes, and sometimes known as Napoleon's willow. An additional area to the south, east of the long lake, is now being developed for the willow family and the walnut family.

The walnuts and their relatives may be found in the region to the north of the willow family and south of the path. The narrow-winged wing-nut, from China, is here. Of the walnuts (*Juglans*), the English Walnut, native from southeastern Europe to China, produces a most desirable nut, often called Madeira nut; the Romans introduced it into Italy, and from that place as a center its cultivation has spread in all directions, both in the Old World and the New; the nuts form a common article of food in southern Europe; in Europe and northern India an oil, called walnut-oil, used as a substitute for olive-oil, is obtained by subjecting the seed-leaves to pressure. The black walnut and the butternut are both wild elsewhere in the Garden,

and the former is also represented here by small trees. The pecan-nut (*Hicoria Pecan*), wild in the south central United States, is another nut of popular favor, as is also the big shag-bark, or king-nut, of the eastern United States. The water hickory, of the southeastern United States, and the bitter-nut or swamp hickory, of eastern North America, are both represented, while the common shag-bark hickory and the pig-nut grow elsewhere in the grounds.

The birch family is located along the driveway, west and south of the stable, where birches, alders and hornbeams are planted; the European hornbeam is represented. The American hornbeam is common in Bronx Park, and the hop-hornbeam is occasional. Those desiring to study the birches (*Betula*) will find several species available; one of these is the yellow birch which grows wild in eastern North America, and is one of our most valuable timber trees; the wood, on account of its closeness of grain, strength and hardness, is suitable for many purposes. Another is the paper, or canoe, birch, of frequent occurrence in northern North America: the wood of this is preferred to that of any other tree for the manufacture of spools, and is also used in the manufacture of shoe-lasts and pegs; the Indians also make use of its wood in the manufacture of sledges, and from its tough bark they also make canoes and baskets. The river or red birch may be seen here; it is frequent along streams and lakes in the eastern parts of the United States; its wood is used in the manufacture of furniture. The black, or sweet birch is in the collection and this and the poplar-leaved birch are wild elsewhere in the Garden. There is also the European white birch and some of its varieties, and the Alleghany birch and others. The alders are present in several species: the dye alder, of Japan, which becomes a large tree; the Japanese alder, also of Japan; the speckled, or hoary, alder, of north temperate regions; and the European tree alder.

The area devoted to the beech family lies to the westward of that assigned to the birch family; the oaks, the

chestnuts and the beeches belong here. The oaks (*Quercus*) are represented by many species. One of these is the pinnatifid-leaved oak, from Japan, with its odd leaves cut into long linear lobes; it is said to be a form of the toothed oak of Japan. Near by is the rock chestnut oak, of eastern North America; its wood is strong and durable, especially when in contact with the soil, and is therefore of great value for railroad ties and fence posts, and its bark is largely used for tanning. The mossy-cup, or bur oak, also of eastern North America, may be found here; this was discovered by the botanist Michaux in 1795, and is a valuable timber tree, its wood largely used for boat-building, for the manufacture of carriages and agricultural implements, for the interior finish of houses, and, on account of its durability in contact with the soil, for railroad ties. The red oak and the swamp white oak are natives of eastern North America; the latter is also a good timber tree, its wood being used for cabinet work and in various kinds of construction. The Japanese silkworm oak forms a part of this collection; its leaves are much like those of the chestnut, and might easily be mistaken for them; it is often planted in Japan in the silk districts, as its leaves are available as food for the silkworms, whence its name; the Japanese make charcoal from its wood, and from the bark they extract a black dye. The post, or iron oak is a native of the eastern United States. Here may be seen also the sessile-flowered English oak, a native of Europe and western Asia. The large-toothed oak, of Japan, a valued timber tree there, is represented near by; as is also the gland-bearing oak, another Japanese species. The shingle, or laurel oak, of the central parts of the United States, is not of much commercial value, as its wood checks badly in drying; it is sometimes used in making clapboards and shingles. Schneck's red oak comes from the south central parts of the United States. The Turkey oak, of south-eastern Europe and western Asia, is valued in that region on account of its bark which is used in tanning leather.

UPPER LAKE AND LAKESIDE SHELTER

Several hybrid oaks form interesting parts of the collection. The swamp oak, the scarlet oak, the black oak and the white oak are to be seen in large wild specimens elsewhere in the grounds.

The chestnuts (*Castanea*) are represented by the Japanese chestnut, of China and Japan. The American chestnut was in former years common about the grounds, some of the trees being large and of great age. The chestnut blight has destroyed or necessitated the destruction of all of these trees. The beeches (*Fagus*) are located in the north part of the swale at the west side of the oak family reservation. The European beech and its purple-leaved variety may both be found here in small, recently planted trees; there are large specimens of the purple-leaved and weeping varieties of this south of the mansion. Small trees of the American beech are also here, but large wild specimens may be found along the driveways and paths in the vicinity; the wood of the beech takes a high polish and is largely used for furniture, while the nuts are edible. The uses of the European beech are about the same as those of the American.

The elm family, to which belong the elms, the hackberries, or sugarberries and the water-elms, is located on the ridge to the north of the stable. Among the elms (*Ulmus*) to be found here is the Scotch, or Wych elm, a native of Europe and Siberia; the late-flowering elm, growing wild from Tennessee to Alabama; the cork, or rock elm, of northeastern North America; the Chinese elm, of northern China and Japan; and the winged elm, or wahoo, of the southeastern United States. The American elm and the slippery elm are wild in the grounds. The hackberries (*Celtis*) represented are the Georgia hackberry, the dog hackberry, and Small's hackberry, of the southeastern United States; and the American nettle-tree, or sugarberry, of eastern North America. The water-elms are illustrated by the pointed water-elm, a native of Japan. The mulberry family is represented by the osage orange

(*Toxylon*), trees of which may be found to the south of the driveway from the long bridge; it is a native of the central parts of the United States; and by the Russian, red and white mulberries. The cercis-leaf family has for a representative the cercis-leaf, of Japan, located just to the south of the row of large tulip trees east of the Bronx River.

The magnolia collection is planted on the west and south sides of the swale between the two ridges. Fraser's magnolia is one of those to be seen here; it is a native of the mountain woods from Virginia to Florida and Mississippi. The cucumber tree, the white-leaved Japanese magnolia, the umbrella tree, and a number of hybrid forms are other magnolias to be looked for here. Large specimens of the umbrella tree and of the large-leaved umbrella tree will be found at the north end of the herbaceous grounds, on the west side; and still other species at the fruticetum. The tulip-tree is shown by a row of fine wild specimens just to the south of the long bridge over the Bronx River, the largest trees within the grounds of the Garden. This tree is native of the eastern United States and yields a valuable lumber known as yellow poplar or white-wood; the Indians formerly made their canoes from this wood. Four parallel rows of this tree form part of the approach to the museum building. Related to the magnolias is the custard apple family, represented by two specimens of the North American papaw, which will be found at the herbaceous grounds on the west side, near the north end; this is a native of the eastern part of the country, from Ontario and New York to Michigan, Nebraska, Florida and Texas. The laurel family is represented by the sassafras, many trees of which may be found wild in various parts of the Garden. The sweet gum (*Liquidambar*), also wild in the grounds, represents the witch-hazel family.

The plane-trees are to be found just to the west of the elms. Here are specimens of the American plane-tree; it is a native of the eastern United States. On a knoll nearby is a large specimen, native to the grounds, of this

THE MANSION

tree, which is also known as the button-wood and button-ball, and there are many other wild trees along the Bronx River. Specimens of the oriental plane, a native from southeastern Europe to India, will also be found here. This is largely planted as a shade tree in Europe, and is often used in this country for the same purpose. The wood of the American plane, or button-wood, is largely used in the manufacture of boxes for tobacco, for furniture, and for the interior finishing of houses.

The apple family and the plum family are located to the north of the driveway leading to the long bridge. In the apple family may be found some of the tree hawthorns and thorns, including the Washington thorn, a native of the southeastern United States. Following to the west are some of the true apples (*Malus*), among them the Siberian crab-apple, a native of eastern Asia; the cherry-leaved crab-apple, presumably a natural hybrid, originally from Siberia; the American crab-apple, from the eastern United States, the western crab-apple, and Soulard's crab-apple, from the central United States. In the plum family, among others, may be found the rose-bud cherry, a Japanese plant, and a highly decorative species; the ordinary sweet cherry, originally from Europe and western Asia, a delicious fruit, of which there are many horticultural forms.

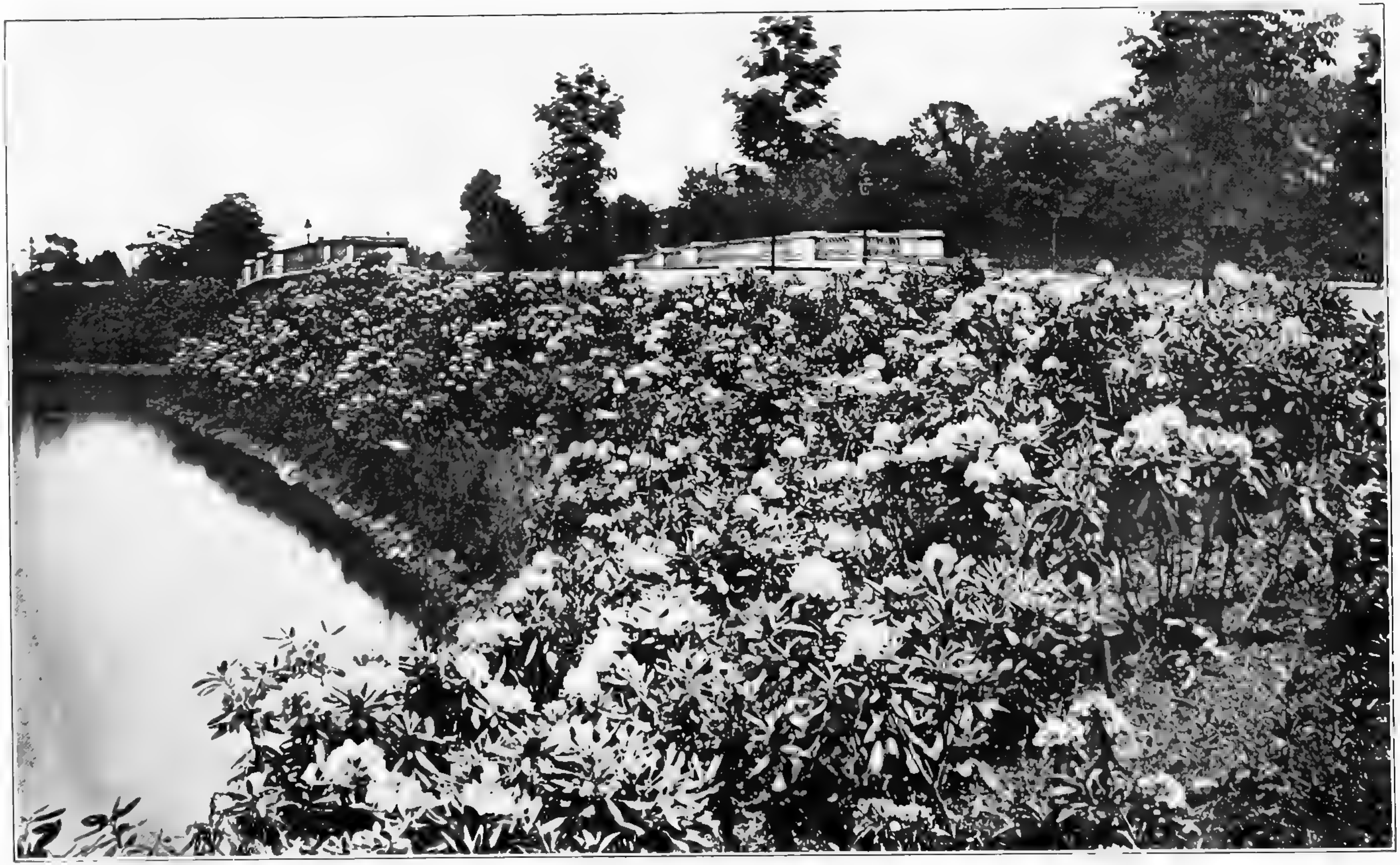
Along the path in the little swale running to the west is a collection of the Japanese flowering cherries which are so highly admired by the Japanese, and this admiration is shared by all who see these specimens at the height of their loveliness which here is about the last week in April or the first in May. There are about one hundred trees in the collection, the blossoms from single to double, and the colors ranging from white to the deepest rose, and one with the blossoms a yellowish green, quite in contrast with the remainder. There is also in this collection a group, occupying the point dividing the paths, of the Japanese weeping cherry; this blossoms two or three weeks earlier than the others; its long drooping branches, clothed with delicate

pink blossoms make of it a graceful and charming object.

Near the eastern end of the long bridge are trees illustrating the senna family, located south of the bridge approach, and the pea family, the true family and the mahogany family on the north side. One of those in the senna family is the honey-locust or three-horned acacia (*Gleditsia*), a native of the southeastern United States; its durability when in contact with the ground makes its wood of especial value for fence posts, for which purpose it is largely used; from China and Japan comes the Japanese locust, also represented here. Another of this family is the Kentucky coffee-tree, in several large and small specimens. One of the representatives of the pea family, from the Amur region, is the Amur yellow-wood (*Maackia*). Another is the locust-tree (*Robinia*), a native of the southeastern United States, but extensively naturalized elsewhere; its wood is hard and close-grained, and is very durable when in contact with ground or with water, so the high value in which it is held for fence posts and for shipbuilding may be readily understood. The rue family has for representatives the Japanese cork-tree (*Phellodendron*), from Japan, and the Asiatic or Sachalin cork-tree, from northeastern Asia. The mahogany-tree family has a single species represented, the Chinese bastard-cedar, a native of China; the mahogany tree itself, and other representatives of the family, will be found at the conservatories.

On the ridge to the northeast of the apple family, and to the west of conservatory range No. 2, are trees of the ailanthus family, represented by the *Ailanthus*, or tree-of-heaven, a native of China, but extensively naturalized in the eastern parts of the United States, where in some places it has become a nuisance, both on account of its ill-smelling staminate flowers and its habit of freely suckering from the roots.

On the ridge to the west of conservatory range No. 2 are representatives of the maple family. The maples (*Acer*) are represented by a number of species. Perhaps the most im-



RHODODENDRON BANKS, LAKE BRIDGE

portant of these is the sugar, or rock maple, a native of eastern North America, and the principal tree yielding maple sugar and syrup. The sap is usually collected from late in February to early in April; trees from twenty to thirty years old are considered the most productive, and a tree will usually yield in a season from four to six pounds of sugar, some giving less and others much more. This tree is often planted for shade along streets and in parks, its beautiful coloring in the fall enhancing its value for this purpose. Its wood is largely used for making furniture, in ship-building, for tool-handles and for shoe-lasts and pegs. From the southeastern United States comes the white-barked maple, also in the collection. Another tree here is the red maple, ranging throughout eastern North America; its wood is now used in large quantities for the manufacture of furniture of various kinds, for gun-stocks, etc. The striped, or goose-foot maple, sometimes known also as moosewood, of northeastern North America, is a pretty decorative species, especially attractive on account of the beautiful marking of its bark. The box-elder, or ash-leaved maple, native of eastern North America, represents anóther type with compound leaves. Three Old World representatives are the common European maple, of Europe and western Asia, the sycamore maple, from Europe and the Orient, and the Norway maple, with a number of varieties, also from Europe and the Orient. The sycamore maple is a valuable timber tree in Europe; its wood is used in the manufacture of musical instruments, spoons and other household utensils. Farther north on this ridge may be seen young trees of *Koelreuteria*, the varnish tree, native of China.

In the buckeye family, planted north of conservatory range 2, is the common horse-chestnut (*Aesculus*); for a long time the native country of this tree was unknown, and its home was ascribed by different authors to various lands; it has been pretty well established now that it is indigenous to the mountains of Greece. Another tree here

is the fetid, or Ohio buckeye, of the central United States; its wood, as well as that of some of the other kinds of buckeye, is manufactured into artificial limbs, for which purpose it is highly esteemed; it is also used for wooden-ware and paper pulp. To the north of the buckeye family is the linden family. The American linden, or basswood, found over the eastern parts of North America, is here; it produces a large amount of lumber under the name of whitewood, which is used in the manufacture of woodenware, furniture and carriage bodies; it is also largely used in the manufacture of paper pulp. Another species is the white, or silver linden of eastern Europe, and a third, the common European linden.

Next in the sequence comes the ginseng family, represented by several species of aralia, while others will be found at the fruticetum; many other species of this family may be found at the conservatories. West of these is the ebony family, represented by the persimmon or date-plum (*Diospyros*), a native of the southeastern United States; its wood is preferred for the manufacture of shuttles; its fruit contains tannin, which gives it its astringent properties; this fruit, when fully ripe, is eaten in large quantities in the southern states, and is also offered for sale in the markets of the north. Larger trees will be found along the driveway east of the museum.

Further down the hill, west of the persimmon group, is a collection of the flowering dogwood, *Cynoxylon floridum*, both the form with white flower bracts and that with red; the white-flowered kind is common in the woodlands.

Beyond the ginseng family, on the western slope of the hill, is the olive family, represented by many species of the ashes (*Fraxinus*), some of which are useful for timber. The common European ash is to be seen, and among the North American representatives are the green ash; the Texas ash, restricted to that state; the Biltmore ash, from Pennsylvania to Georgia; the white ash and the red ash are com-

WATERFALL IN THE HEMLOCK FOREST

mon. Following to the north is the figwort family, represented by *Paulownia*, a native of Japan. Terminating the sequence is the trumpet-creeper family, represented by species of *Catalpa;* among these is the Indian bean, a native of woods in the Gulf States, and Kaempfer's catalpa, from China.

7. Flower Gardens

Collections of herbaceous plants, useful for horticulture, will be found along the west border from near the Mosholu bridge to the Elevated Railway approach; along the path leading from this approach to conservatory range 1 and in the beds in the vicinity of this range; at the iris garden; and at the water garden. Something of decorative value is always to be found in these collections, from the appearance of the early flowering bulbs and other harbingers of spring to the arrival of the chrysanthemums in the fall. The plants are plainly labeled, so that the collections may be intelligently studied. If one is interested in establishing a home garden, notes may be made here of such plants as appeal to the individual, and any color scheme for any period may be thus arranged for. It is not the purpose in these collections to develop any special color scheme, but to bring to the attention of the public as many different kinds as possible of herbaceous plants which may be used in the developing of individual ideas. Many other kinds of herbaceous plants which may be used for decorative purposes may be seen at the herbaceous garden.

The flower beds at conservatory range 1 are on the north side in two series numbered from west to east. One series is of seven beds, and the other is at the base of the terrace on which the conservatory stands, paralleling it on three sides. In these beds and in those on both sides of the path from the Elevated Railway approach to the conservatories are grown many kinds of bulbs, such as snowdrops, glory-of-the-snow, squills, spring crocuses, early tulips, cottage tulips, Darwin tulips, daffodils, poet's narcissus, snowflakes, lilies and fall crocuses. All bulbs have a resting period,

their foliage disappearing at this time, leaving bare spots in the flower garden. To avoid this, annuals, or greenhouse plants raised from cuttings, are provided. These are sown or planted in time to follow the bulbs, thus giving a succession of flowers for the summer and fall. In addition to the bulbs there are many other kinds of herbaceous perennials here.

Bed no. 11, located at the foot of the east terrace, is devoted to roses. This collection was established in the spring of 1913. The bed is about 250 feet long and 8 feet wide. There are over 400 bushes, representing about 140 kinds, including hybrid perpetuals, hybrid teas, teas, baby ramblers, moss-roses and others. The two rear rows contain hybrid perpetuals, and a few other kinds, the two front rows comprising hybrid teas and teas.

The iris garden at the southwest corner of the grounds was established in the spring of 1916. In front of a background of conifers and deciduous shrubs is a border 10 feet wide. The rear portion of this border, with an occasional approach to the front in places, is given over to irises, which may be had in flower, by proper selection of kinds, from early spring to the early part of July. The first to bloom are some of the dwarf forms, such as *Iris pumila* and *I. cristata*. Then come those of the rhizomatous type, with creeping rootstocks, such as *Iris germanica*, *I. pallida*, *I. sambucina*, and many others. These are followed by the Siberian irises, and these in turn by the Japanese irises, of which there are many beautiful color forms. If irises alone are used, a garden of this kind is devoid of flowers after the middle of July, and there are but few irises which appear early in the spring. To avoid this difficulty it is best to plant with the irises spring flowering bulbs, which will give an abundance of color at that time of the year, following these, as they go out of flower, with annuals, which will carry the flowering period through the summer and into the fall. The persistent foliage of the irises, often of a gray green, offers a suitable background for many annuals.

NORTH BRIDGE

The water garden is situated northeast of the museum building between the lake bridge and the Bronx River. An attractive display of hardy water-lilies, many of them Marliac hybrids, may be seen here from June until autumn; while the borders of the lake are planted with a variety of water-loving herbaceous plants and shrubs.

Lakeside Shelter

A concrete shelter-house stands by the path on the southwestern side of the upper lake, which lies just west of the water garden. The southern and eastern banks of this lake are decorated with masses of rhododendrons, mountain laurel, and other shrubs and trees.

8. The Mansion

This large stone house, situated on the high eastern bank of the Bronx River above the waterfall, came to the use of the Garden with the tract of about 140 acres added by the city to the reservation in 1915. At that time it was much out of repair, but considerable work has since been done upon it. The basement is used for shops for storage; the Bronx Society of Arts and Sciences has occupied a part of the building for several years, having museum collections on both the first and second floors as well as the use of a room for its Secretary; the Horticultural Society of New York has been given office room on the second floor; some of the laboratories of the Garden are located here; and part of the first floor has been fitted up for board rooms.

9. Decorative Hardy Collections

Many collections of this nature will be found in various parts of the grounds. They consist of trees and shrubs, both deciduous and evergreen, and of herbaceous plants.

Along the driveways and paths will be found many kinds of deciduous trees, and in the arboretum many other kinds may be studied.

Groups of deciduous shrubs will also be found in many places along the roads and paths, and in the fruticetum, where these are arranged in families, the decorative groups are in close proximity to the families to which they belong. In the fruticetum will also be found a number of evergreen shrubs. Other places where the decorative value of shrubs may be studied are: along the west border, from the Woodlawn Bridge south to the approach to the elevated railroad, and at the foot of and parallelling this approach; along the south border; and in the beds in the vicinity of conservatory range 1. Evergreen shrubs, or small trees which may be used in the same manner as shrubs, are divided into two groups, those with broad leaves, such as the rhododendron, known as broad-leaved evergreens, and those with narrow leaves, sometimes like needles, such as pines, hemlocks, spruces, firs, and yews, known under the general term of coniferous evergreens. The rhododendron is one of the most popular of the broad-leaved evergreens. Collections of rhododendrons may be seen on the east and south banks of the upper lake, just behind the museum building; at the west end of the Boulder Bridge; in front of the fountain at the museum building; and on the north side of conservatory range 1. One of the best broad-leaved evergreens for this latitude is the Japanese holly, *Ilex crenata*, fine examples of which may be found at the foot of the approach to the museum building, and others in some of the beds in the vicinity of conservatory range 1 and at the mansion.

Coniferous evergreens, as individual specimens, may best be studied in the pinetum. Groups of these plants, used in a decorative way, may be found at the foot of the Woodlawn Bridge approach; at the fountain in front of the museum building; at the foot of the museum approach; at the west end of the Long Bridge; and in the beds at the foot of the terrace at conservatory range 1, and in the other beds to the north of the same range. As examples of the mixed planting of deciduous shrubs and of various ever-

BOULDER BRIDGE

greens, beds nos. 1 to 7 at conservatory range 1 and the border screen of the Iris garden may be cited as examples.

10. The Hemlock Forest

The forest of Canadian hemlock spruce along the Bronx River, within the portion of Bronx Park set apart for the New York Botanical Garden, is one of the most noteworthy natural features of the Borough of The Bronx, and has been characterized by a distinguished citizen as "the most precious natural possession of the city of New York."

This forest exists in the northern part of Bronx Park on the banks of the river and their contiguous hills; its greater area is on the western side of the stream, but it occupies a considerable space on the eastern side above the mansion and below the boulder bridge. The area west of the river extends from just above this bridge down stream to a point nearly opposite the old Lorillard snuff mill, and is the part commonly designated "Hemlock Grove." Its total length along the river is approximately 3,000 feet; its greatest width, 900 feet, is at a point on the river about 700 feet above the waterfall at the mansion. The total area occupied by the trees on both sides of the river is between thirty-five and forty acres.

While this area is mostly covered by the hemlock spruces, and although they form its predominant vegetation, other trees are by no means lacking; beech, ash, sweet birch, red maple, hickories, oaks, dogwood, tulip-tree and other trees occur, and their foliage protects the hemlocks from the sun in summer to a very considerable extent; there are no coniferous trees other than the hemlock, however, within the forest proper. The shade is too dense for the existence of much low vegetation, and this is also unable to grow at all vigorously in the soil formed largely of the decaying resinous hemlock leaves; it is only in open places left by the occasional uprooting of a tree or trees by gales that we see any considerable number of shrubs or herbaceous plants, their seeds brought into the forest by wind or by birds. In

fact, the floor of the forest is characteristically devoid of vegetation, a feature shown by other forests of hemlock situated further north. The contrast in passing from the hemlock woods to the contiguous hardwood area which borders them to the west and north, toward the museum building and the herbaceous grounds, is at once apparent, for here we see a luxuriant growth of shrubs and of herbs, including many of our most interesting wild flowers.

11. The Gorge of the Bronx River

The gorge of the Bronx River extends from the boulder bridge at the north end of the hemlock forest southward for about a mile, nearly to Pelham Avenue, and is a most beautiful and picturesque natural feature, besides being of great geological significance. Its depth from the summits of the hills on both sides averages nearly 75 feet, and its sides below the foot-bridge at the mansion are nearly vertical rock faces. The hills on both sides are heavily wooded with hemlock spruces and other trees. In the upper part of the gorge the Bronx flows slowly, being held back by the dam forming the water-fall at the mansion, and the elevation of its surface is only a few inches higher at the boulder bridge, than it is at the fall; after plunging over the dam, however, the river runs in its unobstructed natural channel with all the appearance of a mountain stream, which at high water is exceedingly beautiful.

12. North Meadows and River Woods

The Bronx River enters the northern end of the Garden from Williamsbridge and flows as a slow stream southward to the water-fall at the mansion, its surface being nearly level throughout this distance. It is spanned just inside the northern boundary of the Garden by a concrete-steel arched bridge with granite copings, which carries the main park driveway across it near the Newell Avenue entrance. The entire northern end of the Garden is formed of the flood plain of the Bronx River, consisting largely of grassy

BRONX RIVER ABOVE THE LINNAEAN BRIDGE

meadows and marshes which at average flow of the stream are several feet above its surface, but which at flood time are occasionally submerged for short periods, the whole valley being a very interesting illustration of the behavior of a small stream with a large water-shed at and about its sources. Considerable areas of the marshy land have already been reclaimed by filling, and by the lowering of the dam forming the water-fall at the mansion; the general plan contemplates a much further reduction in the amount of marshy ground, and a further lowering and deepening of the river by dredging, in order to take off freshets with greater rapidity. A part of this flood plain is occupied by the plantations of willows and poplars already described, and these will be considerably extended, but large areas of meadow will be left in their natural condition.

South of these open meadows, the valley of the river is much narrower and is occupied by several acres of characteristic river woods, containing a considerable variety of native trees and shrubs, extending south as far as the long driveway bridge near the northern end of the hemlock forest.

13. Deciduous Woodlands

The natural deciduous woodlands of the reservation are, collectively, over 40 acres in area, mostly in the central and southern portions of the tract, where they occupy rocky ridges and some of the valleys between these ridges. Along the Bronx River, from the boulder bridge north to the north meadows, are several acres of river woods, subject to overflow at freshet periods. The woodlands contain many species of native trees and a much greater number of kinds of native shrubs and herbaceous plants; the undergrowth is, locally, very dense. They are typical illustrations of forests of our part of the country, and are treated and protected as such. Dead and decrepit trees are removed and dead branches pruned off from time to time; where necessary, young trees are planted to replace those cut out; the woods are patrolled to guard against forest fires. All

available firewood obtained is burned in the heating plants of the smaller buildings, and the use of coal is thus reduced. In order to keep these woodland tracts as typical illustrations of eastern United States forests, no extraneous plants have been brought into them, except in one small area on a bank just east of the fruticetum, where many herbaceous woodland species not native of the region have been planted.

14. Park Features

The whole plan of the development of the Garden has been designed in such a manner as to include all the features of a public park, and it has been carried out in close cooperation with successive park commissioners and engineers of the Borough of the Bronx. The grounds are open to the public every day in the year without any charge whatever. An elaborate series of driveways provides several miles of Telford-Macadam roads, most of which are now constructed with suitable entrances at ten points as follows:

1. Mosholu Parkway. 2. Bedford Park Avenue. 3. Southern Boulevard. 4. Iris Garden. 5. Linnaean Bridge. 6. Mansion Approach. 7. Arboretum entrance (not yet completed). 8. A'lerton Avenue. 9. Bronx River Parkway. 10. Woodlawn Road.

Paths located so as to lead to all the principal features are included in the plan, with an aggregate length of over fifteen miles and approximately three-fourths of this system has already been built, and there are several miles of forest trails.

All the roads and paths have been located so as to do no damage to the natural features of the grounds, particular care having been taken to save all possible standing trees and to avoid disturbing natural slopes except in the immediate neighborhood of the large buildings, where considerable grading has been necessary, but even here the study has been to adjust the new surfaces so that they shall merge imperceptibly into the original ones. Ornamental masonry retaining walls, made necessary by the grades of the roadways, have been built at the Mosholu Parkway

A PART OF THE BORDER SCREEN

entrance, at the Woodlawn road entrance, and at the approach to the Elevated Railway station, and vines have been planted at the bases of these walls which partly clothe them with foliage. The Bronx Boulevard, bounding the Garden to the east, is supported along part of its length by a high rubble stone retaining wall.

The plan of the driveway and path systems called for the construction of six bridges; three of these, first, the lake bridge, crossing the valley of the lakes near the museum building; second, the long bridge, which carries the driveway across the valley of the Bronx River north of the hemlock forest; and, third, the upper bridge which crosses the Bronx River at the northern end of the Garden, have been carried out in masonry arches from designs by Mr. John R. Brinley, landscape engineer of the Garden. A unique boulder foot-bridge of five arches, just at the northern end of the hemlock forest was built from designs by the same engineer. The concrete-steel bridge spanning the gorge of the Bronx below the waterfall was built by the Park Department; and the sixth bridge in the plan is a foot-bridge, temporarily built of wood, ultimately designed in concrete, crossing the Bronx River in the north meadows.

The bridge dedicated to Linnaeus, which carries the Pelham Parkway across the Bronx, is appropriately located between the Botanical Garden and the Zoological Park.

The park treatment further contemplates the planting of shade trees where these are needed along the driveways, and much of this has been done, a great many kinds of trees having been used, and many shrub plantations have been set out, especially at roadway and path intersections, utilizing considerable numbers of the same kinds of shrubs at different points.

The drainage of the grounds has been carried out in accordance with a well-studied original plan, which provides outlets for the surface drainage for the most part either into the lakes or into the river, only a small portion of it being taken into the sewers; only a small portion of the drainage system still remains to be built.

The water supply has also been constructed in accordance with the general plan and the system has been extended from year to year as the development of the grounds proceeded.

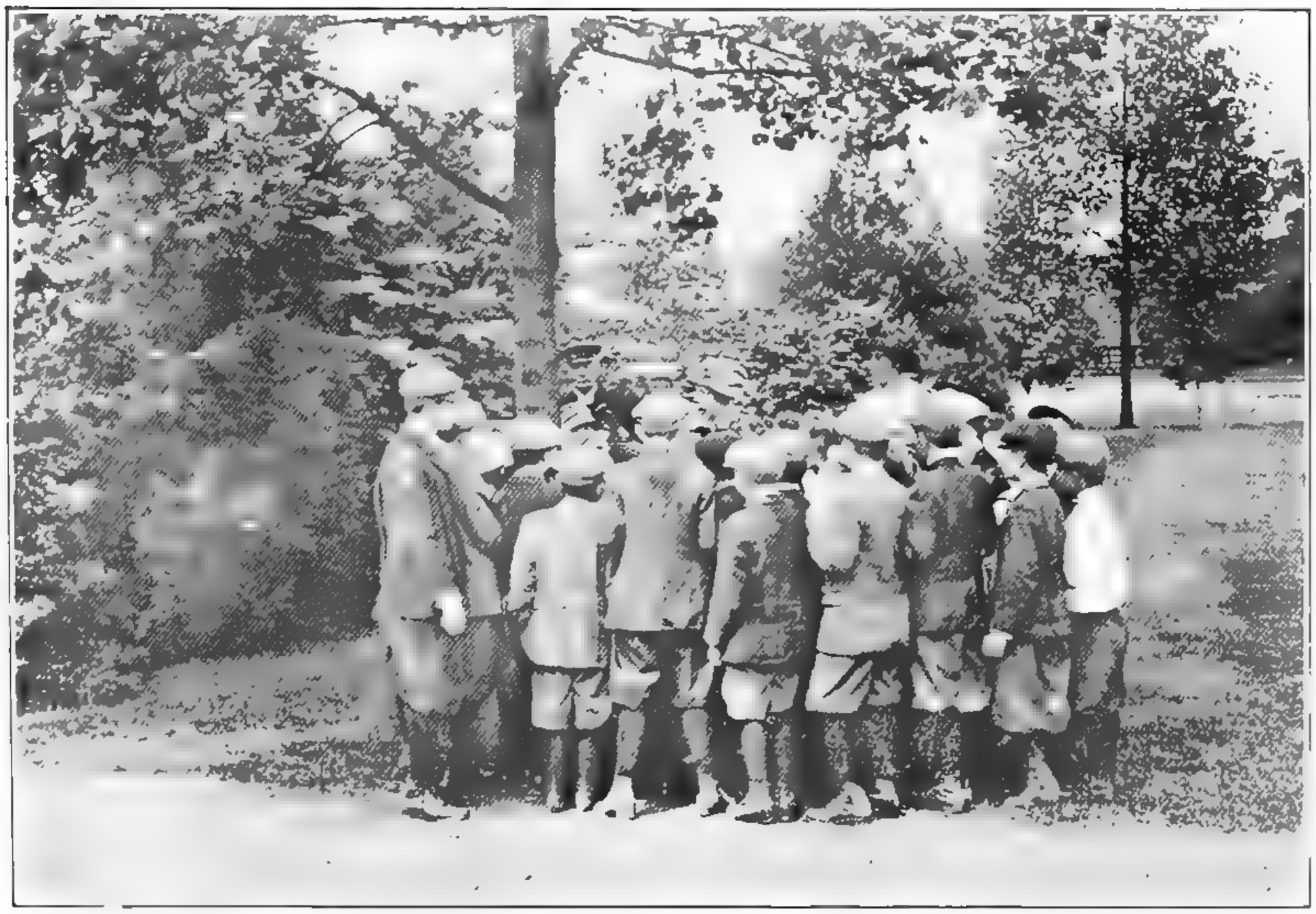
The general planting plan includes provision for partially surrounding the grounds, except at entrances, with border screens. This planting has already been accomplished along the western and northern boundaries, and partly along the southern and eastern boundaries. These screens are composed of a very great variety of trees and shrubs, variously grouped, and average about fifty feet in width.

A feature of this border screen is an old-fashioned flower border, composed of herbaceous plants in large variety, which extends from the 200th Street, or Bedford Park Avenue, entrance northward to the New York Central Railway Station and thence to the Mosholu Parkway entrance, and there is a similar plantation at the Elevated Railway station; here herbaceous perennials are massed in front of a belt of flowering shrubs which in turn are backed by the trees of the border screen, and so selected that some of them are in bloom throughout the season. Among the plants used in this old-fashioned flower border are daffodils, crocuses, irises, phloxes, paeonies, rose mallows, sunflowers, cone-flowers, coreopsis, columbines and many others.

Docentry

In order to provide a method for viewing the collections under guidance, an aid leaves the front door of the Museum Building every week-day afternoon at 3 o'clock, to escort all who may wish to accompany him. The routes are as follows:

Monday: Hemlock Forest, Mansion, and Herbaceous Garden. Tuesday: Pinetum. Wednesday: Fruticetum and North Meadows. Thursday: Deciduous Arboretum, Nurseries and Propagating Houses, and Public Conservatories, Range 2. Friday: Public Conservatories, Range 1. Saturday: Museums.



DOCENTRY

Rules

1. The picking of flowers, leaves, fruits, nuts, or the breaking of branches of any plants, either wild or cultivated, the uprooting of plants of any kind, the defacing of trees, and the carrying of flowers, fruits or plants into or from the grounds of the Garden, are prohibited, except by written permission of the Director-in-Chief of the Garden.

2. Leaving or depositing paper, boxes, glass or rubbish of any kind within the grounds of the Garden is forbidden.

3. Dogs are not allowed within the limits of the Garden except in leash.

4. It is forbidden to take fish from within the Garden, or to molest in any way squirrels, birds, snakes, frogs, toads, turtles or any other wild animals.

5. Throwing stones or other missiles, playing ball, football, tennis, or other game is prohibited.

6. It is forbidden to offer for sale food, candy, newspapers, books, tobacco, beverages, flowers or any other objects, without written permission from the Director-in-Chief and the Commissioner of Parks for the Borough of the Bronx.

7. Boating or rafting on the ponds, lakes and streams is forbidden.

8. Trucking, or the driving of business wagons of any kind, is forbidden on the roads of the Garden, except on those designated for such purposes.

9. It is forbidden to accept or solicit passengers for any cab, carriage, or other conveyance, at any point within the grounds of the Garden without written permission from the Director-in-Chief of the Garden and the Commissioner of Parks for the Borough of the Bronx.

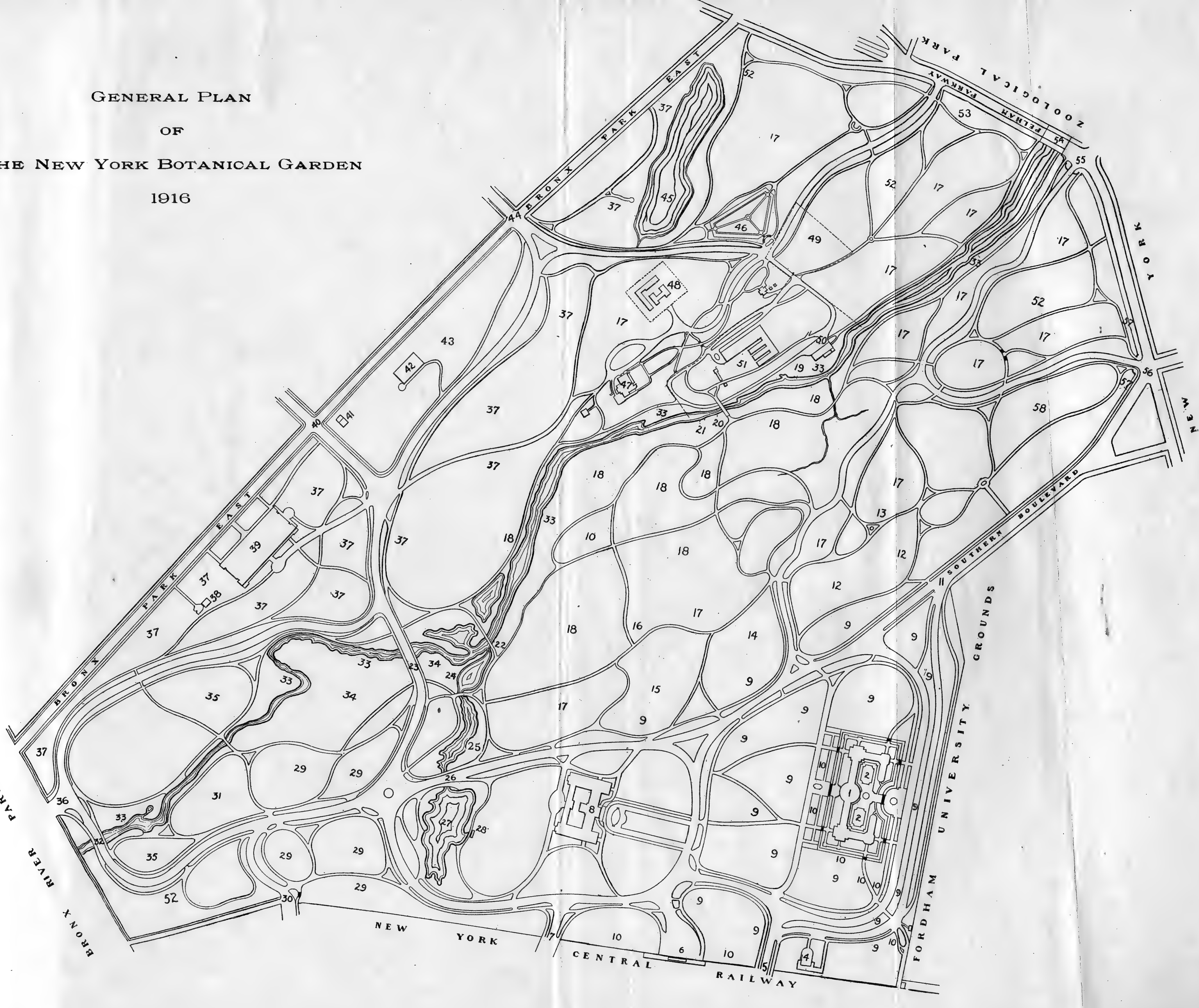
10. Visitors are not allowed within the Garden after eleven o'clock at night nor before six o'clock in the morning except upon driveways and paths designated for their use between those hours.

The Garden is also protected by all city ordinances referring to the Park System.

EXPLANATION OF MAP

1. Public Conservatories, Range 1
2. Water-lily Tanks
3. Elevated Railway Station
4. Power House No. 1
5. Bedford Park Entrance
6. Botanical Garden Station
7. Mosholu Parkway Entrance
8. Museum Building
9. Pinetum
10. Flower Gardens
11. Southern Boulevard Entrance
12. Herbaceous Garden
13. Pergola
14. Morphological Garden
15. Economic Garden
16. Viticetum
17. Deciduous Woodlands
18. Hemlock Forest
19. Gorge of the Bronx River
20. Gorge Bridge
21. Waterfall
22. Boulder Bridge
23. Long Bridge
24. Lower Lake
25. Water Garden
26. Lake Bridge
27. Upper Lake
28. Lakeside Shelter-house
29. Fruticetum
30. Woodlawn Road Entrance
31. Salicetum
32. North Bridge
33. Bronx River
34. River Woodlands
35. North Meadows
36. Bronx River Parkway Entrance
37. Deciduous Arboretum
38. Power House No. 2
39. Public Conservatories, Range 2
40. Allerton Avenue Entrance
41. Stable
42. Propagating Houses
43. Nursery and Experimental Gardens
44. Arboretum Entrance
45. Long Lake
46. Rose Garden
47. Mansion
48. Park Department Barn
49. Park Department Band Stand
50. Park Department Shop
51. Park Department Greenhouses
52. Picnic Grounds
53. Mansion Entrance
54. Linnaean Bridge
55. Linnaean Bridge Entrance
56. Iris Garden Entrance
57. Iris Garden
58. White Pine Plantation

General Plan
of
The New York Botanical Garden
1916



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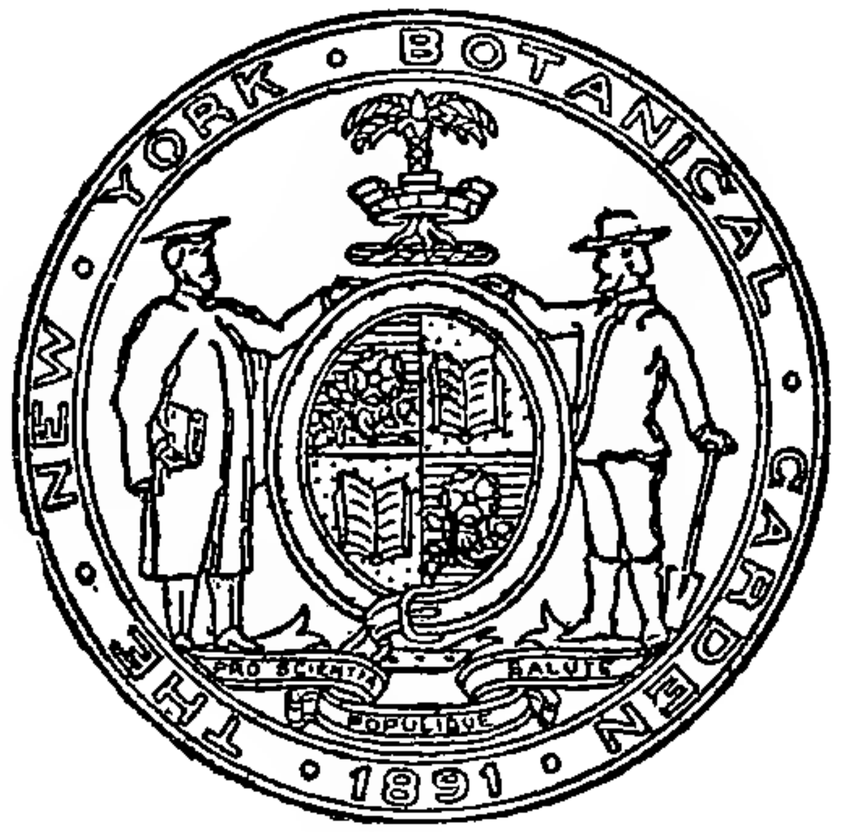
BULLETIN

OF

THE NEW YORK BOTANICAL GARDEN



[ISSUED APRIL 10, 1917]

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BULLETIN
OF
The New York Botanical Garden

Vol. 9 No. 35

REPORT OF THE SECRETARY AND DIRECTOR-IN-CHIEF FOR THE YEAR 1916

(*Accepted and ordered printed, January 8, 1917*)

To the Board of Managers of the New York Botanical Garden.

Gentlemen: I have the honor to submit my report as Secretary and Director-in-Chief for the year ending January 8, 1917.

Progress in the development of the Garden in all its departments has been made during the year and its educational work has been continued. In new construction and new planting, attention has been for the most part concentrated upon portions of the tract of about 140 acres added by the city to the Garden reservation in 1915, but minor work has been carried out in parts of the original area. All the older plantations have been maintained and all land previously improved has been cared for, although not as critically as was desirable, on account of limited funds for expenditure. The greenhouse collections of living plants have been maintained and augmented, and important additions have been made to the museum collections and to the herbarium and library.

A special fund aggregating $8,400, subscribed by 108 members of the Garden, denominated the "Rose Garden and Garden Extension Fund," was expended in improving areas of the additional land, for the planting of a new rose garden, a garden for the use of the Society of American Florists and Ornamental Horticulturists during their con-

vention meeting in New York in the summer of 1917, a large iris garden, and work was commenced in planting an extensive lilac garden. This development included the complete or partial construction of permanent stone paths aggregating 5,479 feet, or a little over a mile, in length, following the general plan approved by you on November 18, 1915; work on these paths is being continued during the winter. Other paths aggregating about 2,000 feet in length have been partly graded.

The kinds of living plants now represented in the collections aggregate approximately 14,106, this being the largest number of kinds as yet brought together by us; of these, about 9,250 kinds are under glass, and the remainder, nearly 5,000 kinds, are out-of-doors. The museums and herbarium were increased by over 40,000 specimens, mainly by exploration and by exchanges with other institutions. Additions to the library aggregate 415 volumes; this collection now contains 27,639 volumes.

The natural features of the reservation have been guarded against vandalism and fire and have suffered no appreciable damage. All portions of the woodlands through which the trails have been fenced with guard-rails in preceding years are more beautiful and interesting than before, the undergrowth and wild flowers in these areas being more luxurious and abundant; extension of guard-rails into other parts of the woodlands is most desirable, but funds for this purpose have not been available.

Saturday public lectures were given in the museum building from April 8 to November 11, to audiences averaging 114 persons. The docentry system has been continued, docents for school children and for parties of adults having been available every week-day afternoon for visits to the grounds, buildings, and collections. Children from the public schools in large parties have been given nature-study instruction by lectures and demonstrations. Advanced students and investigators from other institutions have had the privileges of the laboratories, experimental grounds,

and greenhouses. The library has been used to advantage by many visiting students and investigators. A great amount of information was given out by correspondence and this function of the institution is continually expanding and requiring more of the time of the staff. Botanical explorations resulting in important additions to the collections and to knowledge were carried out in northern Cuba and the Isle of Pines, and in southern Florida. Public exhibitions of plants and flowers have been continued in cooperation with the Horticultural Society of New York.

Publications of the Garden during 1916 include Volume 17 of the *Journal*, Nos. 33 and 34 of the *Bulletin*, Volume 8 of *Mycologia*, 5 parts of *North American Flora*, Volume 6 of the *Memoirs*, 7 numbers of *Contributions*, and the first volume of the new journal *Addisonia*.

Additions to permanent funds include $5,000 bequeathed by Emil C. Bondy, added to the principal of the Endowment Fund for Science and Education; the payment of 35 per cent. of the bequest of $25,000 by Maria DeWitt Jesup, or $8,750 (10 per cent. only of this bequest remains unpaid), added to the principal of the Maria DeWitt Jesup Fund; and students' fees aggregating $261, added to the principal of the Students Research Fund. These payments total $14,011, increasing the whole endowment to $554,009.16. Much larger endowment is needed to enable us to take full advantage of the opportunity for usefulness offered by the development of the institution.

Roads and Paths

Work on the driveway commenced last year at the rose garden site has been continued. About 200 feet of Telford foundation was laid and about 400 feet more has been graded. Earth for the large embankment required, where this road crosses the valley of the long lake, has been dumped in place in large amounts by contractors without cost to the Garden or to the city, and only about 2,000 cubic yards more filling is now required at this point; after

this is obtained during the winter or in the spring, this driveway may be completed and opened for use, with small expenditure.

Construction of paths has been continued on both sides of the river, especially in the tract just south of the herbaceous garden, at the rose garden site, at the iris garden, and in the arboretum, and substantial progress has been made. In my last annual report, I suggested the desirability of competing at least a mile of additional paths during 1916; considerably more than a mile of path has been partially completed, and stone for path foundations has been excavated and deposited in places during the winter. A commencement was also made on the construction of additional paths in the arboretum.

During the season, the Park Department repaired and resurfaced the entire driveway system, and the road surfaces have never before been in as fine condition as they are at present. The process of resurfacing has marred the grass borders of the roads in places; it is intended to repair these by sodding in the spring. As in previous years, the path system has been maintained by us, although this work is referred to the Park Department by the Garden's charter.

None of the bridges in the road and path system have required any repairs during the year; they are all in good order.

Grading and Drainage

At the new rose garden site, an area of somewhat over 1 acre was graded by excavation and by filling with top-soil averaging 2 feet in thickness, over 3,000 cubic yards of top-soil being used here, all of which was obtained in grading paths in other parts of the grounds, following the general plan of development adopted. Considerable rock excavation was found necessary near the western entrance to the rose garden; this is now in progress, and the rock will serve to build the foundations of the path system here and of a considerable part of the path approaches. Con-

siderable grading was also accomplished on the path approaches to the rose garden site. In the construction of paths south of the herbaceous garden, connecting it with the iris garden, a large amount of grading was done, all top-soil needed to make the new surfaces being obtained from the location of paths. Rock excavation at the museum building, which is still in progress, is furnishing stone for the Telford foundations of paths in this area. It was found necessary to rebuild a road culvert in order to obtain satisfactory drainage of this area.

In the area east of the long lake, much grading has been done in order to restore the original surfaces and prepare them for planting, requiring the filling of a deep cut which was made by a contractor some years ago for a temporary construction railroad. Over half an acre of land has here been thus improved.

Water Supply

During the season, at the request of the Department of Water Supply, Gas & Electricity, the water supply of the Garden was transferred from the 36-inch city water main hitherto used to the 48-inch main located alongside of it, thus obtaining considerably better pressure throughout the system; a valve connection to permit this had been constructed at the time the 48-inch main was laid several years ago.

There has been no extension of the water-pipes within the reservation during the year; the system has required ordinary repairs, including stoppage of leaks, renewal of valves, and replacement of hose-taps.

Buildings

An unusual amount of repair and replacement proved to be necessary for the proper maintenance of buildings, requiring more than ordinary expenditure.

Museum Building

Continued trouble was experienced at several places in the roof of the museum building, requiring the relaying of

the tile surface over considerable areas. Several leaks also developed in the cornices, which damaged portions of the interior walls, and several leaders had to be repaired. In the basement, it was found necessary to excavate a portion of the floor and replace leaking water-pipes and steam-pipes, for which a new trench was constructed, thus making the pipes more accessible. One additional museum case was constructed. There is now need for a considerable number of additional museum and herbarium cases, for the display and preservation of important additions to the collections.

Power House 1

The installation of forced draft at power house 1, and the substitution of new grates in order to burn buckwheat coal instead of pea coal, was accomplished during the autumn, as recommended by engineers of the City Finance Department. This has resulted in the consumption of a greater bulk of coal at saving in cost; the enlargement of coal storage capacity here is necessary, because we can now receive not more than about 200 tons of buckwheat coal at any one time, and during severe weather this amount is consumed in about 15 days. The coal bins need to be about doubled in size, in order to permit deliveries of about 400 tons at a time; this would be economical, inasmuch as coal delivered in large quantities can be purchased cheaper than in smaller amounts, and the safety of the greenhouse collections must be carefully considered. It was necessary here to replace 117 boiler tubes, a much larger number than had been anticipated. In order to obtain somewhat greater coal storage place than we had, a shop which occupied space within this power house was moved into the northern runway of the house, by constructing a roof over a portion of this runway.

Conservatory Range 1

About one-half of the exterior roof surface of this great greenhouse was painted during the season, and during this work it was found necessary to replace a considerable

number of the wooden girders. Painting of the remainder of the roof must be continued as early in the coming spring as possible. Some interior painting was also done at this house, and much more is necessary during the coming year. It was also found necessary to rebuild or replace much of the steam-pipe installation in this greenhouse. The plant benches here also came to be in bad condition; they were originally built in iron with slate bottom; the iron has been continually painted from year to year, but has rusted in spite of this care, and the whole system of benches will ultimately have to be rebuilt. We reconstructed the bench on the north side of house 5 during the summer, with reenforced concrete, and this construction should be permanent. It is recommended now that all the benches be rebuilt in concrete from time to time as they become unserviceable.

The Mansion

Repairs to this stone building commenced last year have been continued, including the reconstruction of its western porch, interior and exterior painting and carpentering, and work on the roof. The reconstruction of the large south room on the first floor for a lecture room adjoining the board room, previously authorized, is in progress and it is expected that this new lecture room will be fully equipped within a few weeks.

The other buildings, including conservatory range 2, power house 2, propagating houses, and all four public comfort stations, have required ordinary repairs, which, collectively, took up considerable of the time of our mechanics.

Boundary Walls and Fences

The boundary walls and fences along the property line of Fordham University and along the Bronx Boulevard, constructed in previous years, have not required any attention during the season, but the iron work of both lines, over 4,000 running feet, needs painting this year. Along the Southern Boulevard boundary, from the herbaceous

garden south to the iris garden, a red cedar fence is in progress of construction, posts for this fence having been set during the autumn over a distance of about 900 feet. Part of the posts and the railings for this fence were obtained from a fence built some years ago along the southern border of the old reservation, where it is not now necessary nor desirable; the rest of the material needed was obtained from cedar logs, which have been saved and stacked from time to time, and it is thus not necessary to purchase any material; while not a permanent structure, this fence will serve a most useful purpose in protecting the area which it bounds; a suitable entrance has been provided south of the herbaceous garden.

The report of the Superintendent of Buildings and Grounds hereto appended contains additional details relative to construction and maintenance.

Plants and Planting

The older plantations, including the herbaceous garden, the economic garden, flower gardens and borders, fruticetum, arboretum, and pinetum, have been variously modified in detail; species not before represented have been added to the collections, and some have been lost. Special attention has been given to the trees; large additions were made to the magnolia collection in the spring and to the collection of poplars in the autumn, by the expenditure of a portion of the income of the John Innes Kane Fund. A survey of the trees of the Garden, made during the year by the Head Gardener, shows that 621 different species and varieties are now represented in the collections and woodlands, not including trees grown under glass nor including shrubs; the tree collection is thus coming to be noteworthy, and some of the exotic species first planted have attained considerable size. It is proposed to increase this collection during 1917, both in the number of individual trees and by such of the rarer kinds not yet included which may be obtained, and also to make the various groups more

accessible by additional paths. The encouragement of tree planting by example and precept is most important; its importance, indeed, has not yet begun to be appreciated; the necessity of increasing the supply of forest products is coming to be essential to mankind.

The greenhouse collections have been increased from various sources, and have been carefully maintained. Noteworthy additions were made to the representation of cacti, especially by a fine series brought by Dr. J. N. Rose from northern Venezuela, in continuation of the cooperation in the study of this group with the Carnegie Institution of Washington; Dr. J. A. Shafer, an experienced collector, formerly a member of the Garden staff, has been sent to southeastern South America to obtain representative cacti from the deserts of Paraguay, Uruguay, and western Argentina; the success of this expedition will certainly make the cactus collections of the Garden the most complete and important of any in existence. Noteworthy additions to the palm collection were contributed by Mr. P. A. B. Widener, by Mrs. F. S. Holbrook, and by Miss Jean S. Gordon.

All greenhouse space is now fully occupied and the collections in some of the houses are overcrowded. It is desirable therefore that additional houses be constructed at conservatory range 2 on the eastern side of the Garden. This range of houses will soon become very accessible by the opening of the White Plains Avenue extension of the subway, with a station at Allerton Avenue, within a few minutes' walk.

Iris Garden

At the corner formed by the intersection of the Southern Boulevard and Pelham Avenue, where grading and path building were commenced in 1915, large collections of irises were planted in the spring of 1916. The garden was formed by a backing of evergreen trees and deciduous-leaved shrubs, with a band of irises nearly 400 feet long, faced by spring-flowering bulbous plants, and followed by a

variety of annuals. Mr. T. A. Havemeyer and Messrs. Bobbink & Atkins kindly contributed a large portion of the iris collection here planted. The irises established themselves very well, and will doubtless form a very interesting flower feature in the coming spring. It is planned to extend this plantation northwardly along the path leading toward the herbaceous garden, and it may also be enlarged by planting some irises along the northern and eastern sides of the paths. The total number of named kinds of irises here represented is 394. Many of the plants will be divisible at the end of next season.

Rose Garden

The plans for the new rose garden have already been fully described and illustrated.* Progress in construction during the year has been such as to permit the planting of the greater part of the garden, located in a beautiful valley south of the mansion, east of the snuff mill. The work is in cooperation with the Horticultural Society of New York, this society obtaining all the rose plants necessary; it is estimated that some 4,500 rose bushes will be planted here in April and May. Construction of the central pergola and of the boundary fence planned for this garden has necessarily been deferred, owing to the very high price of iron during the year. It is hoped that special gifts of portions of these structures will permit their erection during 1917. The collections of climbing roses cannot be planted until the pergola and the fence are built. At the western approach to the rose garden, a series of stone steps leading from the driveway level down to that of the garden is required. The path system in and around the rose garden has been so far constructed as to permit easy access to the collection when established; construction work is going forward here during the winter.

* See Jour. N. Y. Bot. Gard. 17: 111–115.

Convention Garden

Plans for the garden to be planted by the Society of American Florists and Ornamental Horticulturists during the coming spring, the annual convention of this society being held in New York in August, 1917, have also been outlined.* An area of about 5 acres, located just south of the herbaceous garden, has been set aside for this purpose, and permanent stone paths have been partially built through it, connecting with the herbaceous garden to the north and with the iris garden to the south, and work on these is also progressing during the winter. Applications for space in this garden have already been received from a number of nurserymen and florists, and it is expected that this area will be the scene of great activity early in the spring. The expenses involved in planting and maintenance of this garden for the season are to be met by contributions from the several exhibitors.

Lilac and Paeonia Gardens

An area of about two acres just north of Pelham Parkway and east of the mansion approach driveway has been selected for extensive plantations of lilacs and peonies. The planting of lilacs was commenced here in the autumn with 57 kinds, grown in our nurseries from cuttings obtained in 1913 by exchange with the Park Department of Rochester, New York. A considerable collection of other kinds obtained several years ago in exchange with the Buffalo Botanic Garden, and now planted on the eastern border of the arboretum with the ash collection, will be transferred to the new lilac garden in the spring, and Mr. T. A. Havemeyer has generously continued his valued cooperation by promising important additions to the collection. The lilacs will form a more or less continuous border around the area when fully installed; a round pool which occupies at present a portion of the space will be filled and considerable additional land for planting thus secured. The

* See Jour. N. Y. Bot. Gard. 17: 172, 173.

collection of peonies, part of which is also promised by Mr. Havemeyer, will be planted within the lilac border thus formed, and both collections will be readily accessible by the path system contemplated for this area in the general plan of development.

Mansion Garden

It is planned to establish a formal flower garden on the present lawn space just south of the mansion, to be built as three terraces on three levels, connected by stone steps, with a suitable path system, the borders to be hedged, using for this purpose a number of different kinds of hedge plants, and thus providing a demonstration of plants available for hedges. At the meeting of the Board of Managers held November 16, 1916, authority was given the Director-in-Chief to invite subscriptions for the construction of this garden and for the further development of the arboretum, and it is hoped that the necessary funds may thus be obtained during 1917.

White Pine Plantation

At the suggestion of Dr. Walter B. James, and through his kind interest, a rocky hill north of the iris garden in the southwestern portion of the Garden was planted with young white pines in the spring, an area of about 1¾ acres being thus occupied.* Dr. James obtained the kind cooperation of the New York State Conservation Commission, and the Hon. George D. Pratt permitted us to purchase 2,000 four-year-old transplanted white pines at a nominal price. The young trees have grown remarkably well during the year, the loss having been inconsiderable, and while not yet conspicuous, the plantation has attracted much interest and favorable comment. Additional grading of the grounds accomplished here will permit the extension of this plantation over about an additional half acre of land, for which purpose we have some white pines in the

* See Jour. N. Y. Bot. Gard. 17: 152-154.

nursery, and it is expected that the others required may be obtained from the same source. This demonstration of forest planting is educationally valuable; the ridge which it occupies was scarcely available for anything but tree planting.

Another ridge parallel to the white pine ridge to the west, along the Southern Boulevard, may well be given to the establishment of a forest of another kind of tree, and it is proposed to study this possibility and determine the most desirable tree to be used there.

Additional data concerning plants and planting will be found in the report of the Head Gardener hereto appended.

Museums and Herbarium

Additions to the museum and herbarium collections have been made by exchanges with other institutions, by exploration and collecting, by purchases made possible by the income of the Maria DeWitt Jesup Fund, and by gifts. Details of accessions and of curatorial work will be found in the report of the Head Curator and of the Honorary Curators hereto appended. The curatorial staff remains unchanged. I have formerly and elsewhere alluded to the desirability of obtaining additional museum and herbarium cases, the collections having outgrown their present accommodation, and many valuable specimens are necessarily retained in storage which should be incorporated or displayed.

Library

It is pointed out in the report of the Bibliographer hereto appended that it is desirable that additional funds be made available for the purchase of books. During the past several years of rapid development of the grounds, very little money has been expended for this purpose, and the reference value of the collection is thus subject to deterioration. It is proposed to expend the greater part of the income of the Maria DeWitt Jesup Fund this year for the increase of the library, but this is not sufficient to meet the

needs of the case, and it is hoped that some special gifts of money may be made to enable us to fill gaps in that collection. The increase of 415 volumes during 1916 was mostly obtained by exchanges with other publishing institutions and by gifts. Important progress has been made in cataloging the library. Here, as in the museums and herbarium, additional cases are now required.

The reports of the Librarian and of the Bibliographer hereto appended contain detailed information relative to this collection.

Laboratories and Experimental Grounds

Investigations by students registered at the Garden have been supervised by the Director of the Laboratories and by other members of the staff in a considerable variety of subjects, as appears from the report of the Director of the Laboratories hereto appended. There have been 14 formally registered students during the year, and a much larger number of persons have been given privileges for short periods of time. Two of these students have been aided by grants from the income of the Henry Iden Fund. Ground at the nurseries on the eastern side of the Garden and portions of the propagating houses have been used for experiments connected with plant breeding and plant physiology and pathology.

The desirability of constructing an additional wing to the museum building, in order to provide more space for museums, herbarium and laboratories, and to permit the extension of the library within the present building is most desirable, as has been pointed out in previous reports.

Public Instruction

Saturday afternoon public lectures were continued in the museum building, from April to November, thirty-two such lectures being delivered, twenty-one of them by members of the staff, eleven by other experts. The first ten of these lectures were on horticultural topics. This lecture course

was aided by contributions of money by members of the Board of Managers, as follows:

Mr. Daniel Guggenheim	$200
Dr. Lewis Rutherfurd Morris	100
Mr. Francis Lynde Stetson	100
Mr. Henry W. de Forest	50
Mr. Louis C. Tiffany	50

The contributions were credited to the Public Lecture Fund.

Nature-study lectures and demonstrations to large numbers of children from public schools were continued, and special lectures were delivered to teachers. Three junior members of the staff have acted as docents, escorting parties of both adults and children to parts of the grounds, buildings, and collections on week-day afternoons, throughout the year, whenever application has been made for such service. Labeling of all collections has been continued.

The report of the Assistant Director hereto appended gives details of educational work and a complete record of publications.

Exploration

Owing to the necessity of using all available funds for supplementing the city allowance for maintenance, major botanical exploration has been essentially limited to expeditions made possible by special gifts. One of these was carried out by the Director-in-Chief, accompanied by Mrs. Britton and by Mr. Percy Wilson, in northern Cuba and the Isle of Pines;* two others were led by Dr. John K. Small, in southern Florida, under the continued liberal patronage of Mr. Charles Deering. The first of Dr. Small's trips included a botanical examination of the Cape Sable region† in the spring; the other, accomplished in the autumn, was given to a continuation of investigations on the flora of the mainland and the Florida Keys. The large

* See Jour. N. Y. Bot. Gard. 17: 64–71.

† See Jour. N. Y. Bot. Gard. 17: 189–202.

number of specimens collected during these expeditions have greatly enriched the Garden's collections, which are now the most complete of any in their representation of Floridian and Cuban plants. Large areas of Cuba are, however, as yet, very imperfectly known botanically. Other collecting was accomplished by Dr. Murrill, in mycological studies in the southwestern Catskills in August,* and in the mountains of Virginia in October. Dr. Pennell and Mr. Wilson continued studies and collections of the local flora within one hundred miles of New York, in cooperation with the Torrey Botanical Club, and thus materially increased the local herbarium.

In the autumn, Dr. J. N. Rose, of the Carnegie Institution of Washington, accompanied by Mrs. Rose, visited northern Venezuela, in continuation of the cactus investigations prosecuted by that institution in cooperation with the Garden, and returned with a large number of plants and specimens, part of which have been added to our collections.

Preservation of Native Plants

The income of the Caroline and Olivia E. Phelps Stokes Fund was used for the reproduction of paintings of three additional wild plants needing protection, liver-leaf, bloodroot, and fringed gentian; these were published in the April, May, and June issues of Garden *Journal*,† with accompanying accounts of the plants written by Mrs. Britton. Separate editions of these illustrations and descriptions were also printed, and added to the nine others previously published. The twelve reproductions have also been framed, and the frames given to schools and located in other public places. The distribution of this literature and of these illustrations has called wide attention to the desirability of protecting native plants.

* See Jour. N. Y. Bot. Gard. **17**: 154, 155.

† See Jour. N. Y. Bot. Gard. **17**: 55, 56; 63, 64; 81, 82.

Addisonia

Publication of this new magazine, founded by a bequest of the late Judge Addison Brown (Addison Brown Fund) for the illustration in color and the description of plants of the United States, and of other plants flowering in the collections of the Garden, was begun in the spring, and the four parts forming the first volume have been issued, each containing ten colored plates with accompanying text. Following the conditions of the bequest, subscriptions to *Addisonia* have been invited, and 220 such subscriptions at $10 per volume have now been received. The magazine is edited by Dr. John H. Barnhart, Bibliographer, and Mr. George V. Nash, Head Gardener.

Investigations

Members of the administrative and curatorial staffs have continued botanical and horticultural investigations during such time as has been available, mostly with direct reference to perfecting the classification of the collections. Students and visitors, working under the direction of the staff, have carried out researches over a considerable range of studies. At the meeting of the Board of Managers held April 20, the Scientific Directors submitted a statement showing that with the present development of grounds, buildings, and collections, additional power of expenditure would, in a few years, if obtained, place the Garden in the position of a botanical and horticultural university.

Women's Auxiliary

At a meeting of the Women's Auxiliary held at the mansion on April 12, the following additional members were nominated; and at the meeting of the Board of Managers on April 20, were duly elected:

Mrs. Walter Jennings,
Mrs. Hamilton Fish Kean,
Mrs. Charles D. Dickey,
Mrs. Charles MacVeagh.

The spring inspection of grounds, buildings, and collections on May 4 was successfully carried out under the auspices of the Auxiliary.* Members of the Auxiliary visited the Garden on the afternoon of October 26, with members of the Corporation, to view construction work in progress.

Administrative

A vacancy in the Board of Managers was filled in June by the election of Mr. Adolph Lewisohn for a term expiring in January, 1919.

Maintenance details have been largely referred to Dr. W. A. Murrill, Assistant Director, and to Mr. R. S. Williams, Administrative Assistant, under my immediate supervision. I have personally supervised all new construction, including paths, drainage and grading, and the development of new plantations, which has been under the immediate direction of Mr. Arthur J. Corbett, Superintendent of Buildings and Grounds, and of Mr. John Finley, Foreman Gardener. The immediate care of the collections of living plants and of new planting has been in charge of Mr. George V. Nash, Head Gardener, and the care and increase of the museum collections has been under the direction of Dr. John K. Small, Head Curator, and others of the curatorial staff. The laboratories and experimental grounds have been in charge of Dr. A. B. Stout, Director of the Laboratories, and the library has been administered by Dr. John H. Barnhart, Bibliographer, and Miss Sarah H. Harlow, Librarian.

I have continued, during times not required administratively, investigation of the cactus family in cooperation with Dr. J. N. Rose, of the Carnegie Institution of Washington, and two volumes of the Monograph of the Cactaceae to be published by that institution are now essentially completed; I have also given some time to the continuation of my investigations on the flora of the West Indies.

* See Jour. N. Y. Bot. Gard. **17**: 74.

Financial Considerations

The restriction in funds available for maintenance, mentioned in my last annual report, necessitated, as was foreseen a year ago, the use of practically all our income from endowment and from membership dues to supplement the city maintenance appropriation, leaving us little for the increase of the collections or for educational work. The city maintenance appropriation for 1917 has been increased over that for 1916 by $9,597. The annual membership of the Garden during the year has been somewhat increased, as also the permanent funds. On the other hand, the prices of all material and supplies have risen, and it has been necessary to somewhat increase the remuneration of some employees, while the need for additional employees, owing to the improvement of additional land, will require increased expenditure in order to effect satisfactory maintenance.

Reports Appended

Appended reports include those of the Assistant Director, the Head Gardener, the Head Curator of the Museums and Herbarium, the Director of the Laboratories, the Superintendent of Buildings and Grounds, the Librarian, the Bibliographer, the Honorary Curator of the Economic Collections, the Honorary Curator of the Collection of Fossil Plants, the Honorary Curator of Mosses; also a list of subscriptions to the Rose Garden and Garden Extension Fund, and a schedule of expenditures by the Accountant.

Respectfully submitted,

N. L. Britton,
Director-in-Chief.

REPORT OF THE ASSISTANT DIRECTOR

Dr. N. L. Britton, Director-in-Chief.

Sir: I have the honor to submit the following report for the year 1916.

The weekly reports of the Superintendent are submitted herewith for your files to supplement the annual reports to

follow, which include only the more important details of maintenance for the year.

The season of 1916 was a very favorable one for herbaceous plants and deciduous trees. A cool, late spring was followed by a wet summer and an unusually dry autumn. There were no floods, but two rather severe storms destroyed several trees in the woodlands.

In spite of the summer rains, there were fewer mosquitoes here than ever before. This was due partly to the late spring and partly to the consistent use of kerosene year after year. The elm-leaf beetle was conspicuous by its absence here as in other localities, its disappearance being apparently due to natural conditions rather than to artificial control.

Dr. Seaver noticed considerable damage from the pine-shoot moth and other similar moths which attack the young shoots of various species of pines. Large numbers of infected shoots were cut and burned in order to prevent the spread of this insect. The pine-shoot moth is comparatively new, having been introduced into this country from Europe.

The rose beetle was unusually destructive to shrubs during the past season. No remedy seems to be effective in the control of this insect except hand-picking, which was resorted to in the case of the more choice shrubs, especially roses. The ash borer has become so destructive that the planting of any variety of ash for street or ornamental purposes seems hardly justifiable until some artificial means of controlling this insect can be worked out.

The tussock moth made an inroad on the trees near the Elevated Railway approach, but was largely held in check by timely spraying. It only remains to destroy during the winter any egg-masses that may have been formed by moths that survived.

Publications

Journal

The *Journal* has been published for each month during the year, making a volume of 246 pages, with 24 plates.

Mycologia

This periodical has appeared on alternate months during the year, making a volume of 337 pages, with 24 plates.

North American Flora

Volume 9, part 5, containing descriptions of Agaricaceae (pars), by W. A. Murrill, appeared June 7, 1916.

Volume 9, part 6, containing descriptions of Agaricaceae (pars), by W. A. Murrill, and a bibliography, by J. H. Barnhart, appeared October 10, 1916.

Volume, 9, part 7, by W. A. Murrill, containing the various indexes necessary to the completion of the volume, appeared October 25, 1916.

Volume 21, part 1, containing descriptions of Chenopodiaceae, by Paul C. Standley, appeared November 27, 1916.

Volume 34, part 3, containing descriptions of Carduaceae-Anthemideae, by P. A. Rydberg, appeared December 29, 1916.

Bulletin

Bulletin No. 33, with 93 pages, was issued March 20, 1916. It contains the annual reports of the Director-in-Chief and other officers for the year 1915.

Bulletin No. 34, with 114 pages, 24 plates, and one map, was issued September 21, 1916. It is a descriptive guide to the grounds, buildings, and collections. Separates of this number have been bound for use on the grounds.

Memoirs

Volume VI. Papers Presented at the Celebration of the Twentieth Anniversary of The New York Botanical Garden. viii+592 pp., with 43 plates, was issued August 31, 1916.

Addisonia

The first volume of this publication, containing 85 pages of popular descriptions and 40 colored illustrations of plants, appeared in four parts, issued in March, June, September, and December.

Contributions

No. 186. Notes on Trichomanes—I. The Identity of Trichomanes pyxidiferum L., by Margaret Slosson.

No. 187. Notes on Plants of the Southern United States—I, by Francis W. Pennell.

No. 188. Notes on Species of Halymenia, by F. S. Collins and M. A. Howe.

No. 189. Peruvian Mosses, by R. S. Williams.

No. 190. Phytogeographical Notes on the Rocky Mountain Region.—VI. Distribution of the Subalpine Plants, by P. A. Rydberg.

No. 191. Notes on Plants of the Southern United States—II, by Francis W. Pennell.

No. 192. Studies of West Indian Plants—VIII, by Nathaniel Lord Britton.

Lectures

Public Lectures

Illustrated public lectures on botanical and horticultural subjects have been given in the museum building on Saturday afternoons from April to the middle of November, as outlined below. The total attendance for the year has been 3,327, averaging 104 for each of the 32 lectures; the maximum attendance being 205 on May 13. The first ten lectures of this course were devoted to horticulture, with an average attendance of 113.

April 8. "The Outlook in Horticulture," by Professor L. H. Bailey.

April 15. "How the Landscape Gardener Uses Plants," by Professor F. A. Waugh.

April 22. "The Gladiolus," by Hon. Arthur Cowee.

April 29. "Perennials," by Mr. Maurice Fuld.

May 6. "Rock Gardens," by Mr. Richard Rothe.

May 13. "Irises for American Gardens," by Mr. Arthur Herrington.

May 20. "Valuable Plants Introduced from China," by Mr. Frank N. Meyer.

May 27. "Plant Hunting in China," by Professor E. H. Wilson.

June 3. "Flowers from Snow to Snow," by Mr. J. Otto Thilow.

June 10. "The Mysteries of the Flowers," by Mr. H. W. Faulkner.

June 17. "Floral Features of the American Equatorial Belt," by Dr. H. H. Rusby.

June 24. "Floral Features Observed in a Journey to and from California," by Dr. H. H. Rusby.

July 1. "Wild Flowers of Summer," by Dr. N. L. Britton.

July 8. "Botanizing in Sweden," by Dr. W. A. Murrill.

July 15. "The State Park at Devil's Lake, Wisconsin," by Dr. A. B. Stout.

July 22. "The Plant Life of the Sea," by Dr. M. A. Howe.

July 29. "Popular Books on Botany," by Dr. J. H. Barnhart.

August 5. "Destructive Insects," by Dr. F. J. Seaver.

August 12. "The Summer Flower Garden," by Mr. G. V. Nash.

August 19. "Among the Cañons and Deserts of Southeastern Utah," by Dr. P. A. Rydberg.

August 26. "From the Colorado Foothills to Yellowstone Park," by Dr. F. W. Pennell.

September 2. "Plants of the Danish Islands, St. Croix, St. Thomas, and St. John," by Dr. N. L. Britton.

September 9. "Across Mexico from Vera Cruz to Colima," by Dr. W. A. Murrill.

September 16. "Farming in the Middle West," by Dr. G. C. Fisher.

September 23. "Through the Mountains of Utah and Colorado," by Dr. F. W. Pennell.

September 30. "Flowers for Fall Planting," by Mr. G. V. Nash.

October 7. "Botanical Cruises in the Bahamas," by Dr. M. A. Howe.

October 14. "Destructive Fungi," by Dr. F. J. Seaver.
October 21. "Autumn Coloration," by Dr. A. B. Stout.
October 28. "The Potato Family," by Dr. H. H. Rusby.
November 4. "The New York Botanical Garden," by Dr. N. L. Britton.
November 11. "Planning Next Year's Flower Garden," by Mr. G. V. Nash.

Docentry

Over 1,800 visitors, including classes from public and private schools, have availed themselves during the year of the privilege of viewing the buildings and grounds under the guidance of Mr. Percy Wilson, Mr. R. S. Williams, and Mr. H. W. Becker.

Nature Study

The usual nature-study lectures, with accompanying demonstrations, for pupils of the 4B and 5B grades of the Public Schools of the Bronx, were given in the lecture hall of the Museum Building of the Garden during May. The course included six lectures, by Dr. N. L. Britton, Dr. H. H. Rusby, Dr. M. A. Howe, Mr. G. V. Nash, and Dr. F. J. Seaver, assisted by six teachers as demonstrators. One lecture was abandoned on account of inclement weather. The total attendance at these lectures was 1,845.

On June 22, about 450 biology pupils from the Evander Childs High School accompanied by their teachers came to the Garden for special study of certain collections under the guidance of members of the staff, after which they attended an illustrated lecture on forestry given in the lecture hall by Mr. George E. Hewitt.

On July 6, the biology teachers in attendance at the annual convention of the National Education Association visited the Garden and were conducted through various portions of the grounds and buildings by members of the Garden staff.

On July 27, over fifty students from the summer school of Columbia University made an excursion to the Garden, which was led by Mr. L. W. Crawford and four members of the Garden staff.

On September 12, a Teachers Institute meeting on nature study was held at the Garden for public school teachers of the Bronx. The main address was by Dr. Peabody, after which there was an excursion led by Mr. Percy Wilson.

On September 14, about 160 teachers from the public schools of the Bronx met at the Garden to hear an illustrated lecture by Mr. George V. Nash on "How the Public Schools can use the Collections of Living Plants at the New York Botanical Garden." After the lecture, there was an excursion to various parts of the grounds under the direction of Mr. Percy Wilson.

On October 4, over 50 pupils from the senior class of Morris High School came to the Garden to study methods of propagation in plants and some of the principles of plant breeding, under the direction of Dr. A. B. Stout.

On December 7, about 100 children of the 5B grade from P. S. 10 of the Bronx received instruction at the Garden in the classification of plants.

Scientific Meetings

The monthly conferences of members of the staff and students have been continued, and a report of each meeting has been published in the current number of the *Journal*.

The Torrey Botanical Club has met each month as usual in the morphological laboratory in the museum building.

The Horticultural Society of New York, in cooperation with the New York Botanical Garden, held exhibitions of plants and flowers in the museum building on May 13 and 14, May 20 and 21, June 24 and 25, August 19 and 20, and September 23 and 24.

Personal Investigations

Three parts of *North American Flora*, containing descriptions of 476 species of the higher fleshy fungi, 150 of which were new, were published during the year.

Articles contributed to *Mycologia* also contained a few new species. The popular illustrated articles on fungi in

Mycologia have been continued with the aid of colored plates, 15 species having been treated in this series during the year.

Many important collections of the larger fungi have been sent in for determination. I obtained 400 specimens in the Catskills in August and 75 specimens in the mountains of Virginia late in October, together with considerable field information.

Respectfully submitted,

W. A. MURRILL,
Assistant Director.

REPORT OF THE HEAD GARDENER

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to submit herewith my report as Head Gardener for the year 1916.

Systematic Plantations

HERBACEOUS GROUNDS. The collections here are contained in 130 beds, 26 east of the brook and 104 west. There are in these collections about 3,150 species and varieties. In the American wood garden there are, in addition to these, 44 species not represented here. There have been 497 show labels made for this tract.

The details of the curatorial work in this and in the other herbaceous collections have been in charge of Mr. K. R. Boynton, Head Gardener's Assistant.

FRUTICETUM. Here are 2,752 specimens, representing, including those still at the nurseries, 52 families, 137 genera, and 932 species and varieties. In addition, there are in the American wood garden 2 genera and 2 species not here. 335 individual show labels have been placed here.

SALICETUM. The willow collection contains 119 specimens, representing 48 species and varieties.

DECIDUOUS ARBORETUM. Including those native to the tract and those still in the nurseries, this collection contains 366 species and varieties. There are 1,040 in-

dividual trees, representing 31 families and 58 genera. 45 show labels have been made for this collection.

PINETUM. Here there are 1,501 trees and 271 species and varieties, representing 3 families and 20 genera. The severe and unusual conditions of the past winter resulted in the loss of a number of species and varieties, so that the representation is not quite as large as heretofore. 410 show labels have been placed here.

VITICETUM. There are here about 50 species and varieties of climbers.

CONSERVATORIES. The collections under glass comprise about 9,250 species and varieties, representing 207 families and 217 genera. The total number of plants in the public conservatories is 17,444.

Range 1. There are here 10,696 plants, distributed as follows: house 1, 306; house 2, 450; house 3, 550; house 4, 440; house 5, 1,553; house 6, 487; house 7, 939; house 8, 768; house 9, 142; house 10, 876; house 11, 455; house 12, 1,142; house 13, 512; house 14, 713; house 15, 1,180; cellar, 133. 1,506 show labels have been placed here.

Range 2. The collections here contain 6,748 plants, distributed as follows: house 1, 76; house 2, 152; house 3, 60; house 4, 1,353; house 5, 2,088; house 6, 1,672; house 7, 1,295; runway, 52. 1,049 show labels have been made for this range.

PROPAGATING HOUSES AND NURSERIES. Excluding the plants used for special studies by the Director-of-the Laboratories, there are here 9,032 plants. 833 packets of seeds have been received, as follows: gift, 34; purchase, 254; exchange, 522; collected, 23. There have also been collected on the grounds, in addition to the above, 725 packets. The Director-of-the-Laboratories has had the use of house 2 and parts of other houses for his experiments and those of his students. The succulents, mainly cacti, have occupied houses 5 and 6 and part of house 1. The nursery enclosure, which has been enlarged, and increased areas outside have been used by the Director-of-the-Laboratories and his students.

LABELING, RECORDING, AND HERBARIUM. The work of recording accessions, the manufacture of labels, and the preparation of all herbarium specimens made from plants in the conservatories and in the hardy woody collections have been performed by one gardener and an apprentice. Accession numbers 43,629 to 45,194 have been recorded, making a total of 1,566 accessions. 5,230 show labels have been made, as follows: deciduous arboretum, 45; fruticetum, 335; herbaceous grounds, 501; economic garden, 60; morphologic garden, 7; west border, 9; border at elevated approach, 13; rose bed, 86; iris garden, 54; lilac group, 73; pinetum, 410; trees along roads and paths, 73; conservatory flower beds, 973; conservatory range 1, 1,506; conservatory range 2, 1,049; conservatory court, 36.

The accessions in plants are as follows: by gift, 4,899 (of which 4,012 are bulbs), valued at about $785; by exchange, 553; by purchase, 10,440 (including 7,075 bulbs); by collections made by members of the staff and others, 908; derived from seeds from various sources, 1,456; total, 18,256.

The herbarium of cultivated plants has been increased by about 800 specimens. There are in the collections approximately the following number of species and varieties: conservatories, 9,250; herbaceous grounds, including 39 kinds in the American wood garden not represented here, 3,189; fruticetum, 932; salicetum, 48; deciduous arboretum, 366; pinetum, 271; viticetum, 50; total 14,106.

Miscellaneous Collections

Under this heading are contained: the morphologic garden; the economic garden; the collections of desert plants placed during the summer in the court of conservatory range 1; the conservatory lily pools; the aquatic garden; the rhododendron banks in the vicinity of the lakes; the rose bed east of conservatory range 1; the flower gardens in the immediate vicinity of conservatory range 1, at the elevated approach, and the west border; the American wood garden

(of the species originally placed here about half have survived); and groups of shrubbery in many parts of the grounds.

IRIS GARDEN. At the southwest corner of the Garden an iris garden was established the past spring. A planting of evergreens with deciduous shrubs in front parallels both the Southern Boulevard and Pelham Parkway. In front of this planting is a border 10 feet wide, 180 feet long on the Southern Boulevard side and 200 feet long on the Pelham Parkway side. This border is planted in the rear with irises, in the front with bulbs, followed with annuals. Most of the irises flower late in May and in June, the bulbs making a flower display previous to this, and the annuals continuing the display after the irises are done flowering. In this way a maximum of display is effected throughout the spring, summer, and fall.

To the display of irises here, Mr. T. A. Havemeyer gave a collection of 357 kinds, one plant of each; these are in the bed paralleling Pelham Parkway. Messrs. Bobbink and Atkins also gave a collection, 68 kinds and 378 plants. The total number of kinds is now 394 and the number of plants 1,059.

The triangle formed by the paths of the garden was planted with *Tsuga canadensis pendula*, the weeping dwarf hemlock, and *Pinus montana Mughus*, the knee pine.

MAGNOLIA GARDEN. In the valley south of the Japanese cherry collection it was decided to establish a garden for magnolias. In the northern end of this valley, the magnolias of the arboretum collection were situated. At the time of the spring inspection, this collection was enlarged by the addition of 55 more plants, making the total number of individuals 85 and the number of kinds 21.

LILAC AND PEONY GARDEN. A garden for lilacs and peonies was begun this fall in the open area along Pelham Parkway to the east of the Mansion driveway. It is planned to place the lilacs in groups around the border of this area, and to dispose the peonies in beds irregularly

arranged in the central portion. 144 plants, representing 57 kinds, were planted this fall in three groups along the Pelham Parkway side. These plants were derived from soft-wooded cuttings secured in the summer of 1913 by exchange with the Park Commission of Rochester, N. Y.

American Thorn Garden. This was established this fall on a ridge in the vicinity of the iris garden. 75 individuals of American thorns, the genus *Crataegus*, were set out.

White Pine Plantation. This was planted in the spring with about 1,800 four year old transplanted seedlings, secured, through the courtesy of Dr. Walter B. James, from the State Conservation Nursery near Saratoga, N. Y.

General Horticultural Operations

The following force has been available for carrying on this work: monthly, 2 foreman gardeners, 24 gardners, and 5 drivers; laborers, about 21.

The outside work was in charge of foreman gardener John Finley, to whom was assigned 7 gardeners and the laborers, including those employed in cleaning the walks, and the drivers.

The work in the conservatories and propagating houses has been in charge of H. W. Becker, foreman gardener, to whom were assigned 16 gardeners.

There has been accomplished the following new work, in addition to the regular routine operations:

In the Spring

The past winter was unusually severe upon evergreens, many specimens in both the systematic and decorative plantations succumbing to the uncommon conditions. The losses were replaced in so far as possible by specimens from other plantations which were becoming too crowded, especially from those at the Woodlawn Road approach, the west end of the long bridge, and the conservatory beds. Many of the duplicate groups of herbaceous plants in the

conservatory beds at range 1 were eliminated and replaced with other kinds not then in the beds. Some of the surplus thus resulting was used in the establishment of the iris garden, previously described, and in the installation of a planting of suitable irises along the west shore of the Bronx River north of the Linnaean bridge, the remainder going to the Department of Parks, Borough of the Bronx, as an exchange. The magnolia garden, already referred to and described, was planted at the time of the spring inspection, as was the collection of American thorns in the vicinity of the iris garden. The triangle at the southwestern corner of the terrace, conservatory range 1, already partially planted with *Chamaecyparis*, was further developed by the addition of other specimens of the same genus, obtained from the conservatory beds and elsewhere. The removal of plants from the groups at the Woodlawn Road approach and at the west end of the long bridge required considerable rearrangement at these points; this was attended to.

In the Fall

Initial work in the establishment of the lilac and peony garden, already referred to, was accomplished by the planting of lilacs. The transplanting of thorns to the American thorn garden from the nurseries and also of many specimens of various kinds to the different systematic collections was accomplished. Flower beds 1 and 2 at conservatory range 1 were entirely replanted, the plants being removed, the soil respaded and manured. The bulbs in all the other beds were removed and the areas spaded and manured, the bulbs then being replaced. A large number of duplicate bulbs was thus obtained by division, and these were utilized in plantings elsewhere, especially at the iris garden. Tulips were planted in the beds at conservatory range 1, the centre bed with the Darwin tulip Margaret, the gift of John Scheepers and Co., Inc., 4,000 bulbs being used. The beds of the fountain at the foot of the museum approach were also planted with tulips. A corner near the Park

Department propagating houses was also planted with shrubs. Considerable other work planned for the fall had to be deferred until the spring, as the unusual dry weather of the fall prevented an earlier undertaking of transplanting work.

Investigations and Lectures

In addition to my routine duties, I have continued my studies upon North American orchids, and have given much time to horticultural botany and to an investigation of the hardy woody plants of the collections and to those native to the Garden.

I have given four lectures in the regular courses of public lectures at the Garden. I have continued my work of superintending the making of colored drawings for *Addisonia*, and have acted, with Dr. Barnhart, as one of the editors of this publication.

Respectfully submitted,

GEORGE V. NASH,

Head Gardener.

REPORT OF THE HEAD CURATOR OF THE MUSEUMS AND HERBARIUM

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I submit herewith my report as Head Curator of the Museums and Herbarium for the year 1916.

The collections and exhibits in my charge were developed and maintained as in previous years. One special exhibition case was added to the museum equipment.

The collections were increased by miscellaneous specimens which were accessioned in the *Journal* from month to month. The accessions for the year may be summarized here as follows:

By gift and purchase.	3,850
By exchange.....	4,116
By exploration.....	32,625

Thus 40,591 museum and herbarium specimens were

brought together. The value of the specimens received as gifts is estimated at $152.40.

An aggregate of 7,815 duplicate specimens was sent to other institutions and to individuals as exchanges.

Museums

The several departments making up the public museums were developed mainly by the addition of specimens received through gifts, exchanges, and exploration.

THE ECONOMIC MUSEUM was increased by the addition of miscellaneous specimens and by the installation of a special case devoted to the crude fibers of the Philippine Islands. This case is on the south wall of the west hall of the museum. It contains forty-eight specially prepared specimens which were given to the Garden by Mr. Theodor Muller who made the collection while in residence in the Philippine Islands several years ago.

THE SYSTEMATIC MUSEUM comprises the following collections:

a. *The Synoptic Collection*, which was increased by the interpolation of miscellaneous specimens. The exhibits of some cases were rearranged.

b. *The Local Flora* was increased by the addition of a few specimens and the relabeling of several of the specimens previously installed.

c. *The Microscope Exhibit* remained the same as last year, except for the renovation of the objects exhibited under the microscopes.

d. *The Plant Picture Exhibit* was not changed except in the case of several frames in which the photographs had become damaged or had deteriorated.

THE FOSSIL PLANT MUSEUM was increased by the addition of about seventy specimens representing plants of the Carboniferous, Tertiary, and Quaternary periods.

The catalogue of type and figured specimens contained in the collection of fossil plants was finished together with a bibliography. For further details see Report of the Honorary Curator of Fossil Plants.

Herbaria

The specimens that were received for these collections came chiefly from North America, both insular and continental. Some material was derived from South America and some from the Old World. From the aggregate of specimens received during the year and previously, about 45,000 specimens were selected for incorporation in the permanent collections. About 16,000 sheets of mounting paper were used, and several hundred specimens, mostly fruits and seeds, and other parts of plants, were placed in cardboard boxes.

The great majority of the specimens mounted during the year were from the West Indies, the United States, and Canada. The selections being made from collections bearing more directly on the several lines of work being carried on by members of the Garden staff.

All exsiccatae received were prepared and distributed in their proper places. Thus the specimens were available for use at once.

The fungous collections were increased by valuable specimens from several of the States, particularly California, New Mexico, and Florida, and from Porto Rico, the Isle of Pines, and Surinam. The algal collections were augmented by specimens from North Carolina, the West Indies, particularly Bermuda, and from Australia. The bryophytic collections were increased by miscellaneous specimens from nearly all parts of the globe, and more particularly by collections from Cuba and from southern Florida. Type specimens and numerous critical specimens of groups bearing directly on the work now being carried on were added in several groups. The fern collection received many miscellaneous additions. Also collections from the West Indies and valuable specimens, particularly Mexican, from the herbarium of Prince Roland Bonaparte. The more noteworthy specimens incorporated in flowering plant collections were cacti from North America and South America and general and special series of plants from Can-

ada, various of the States, Mexico, the West Indies, particularly Cuba, Jamaica, and Porto Rico, and South America.

Miscellaneous specimens received for the Columbia University herbarium were mounted and incorporated in that series.

Considerable time was devoted to repairing some of the older specimens and to more securely mounting many previously mounted specimens that were needed for special study. Much attention was devoted to the remounting and rearranging of the collection of lichens and parts of the collection of fungi.

Investigations and Assistance

Dr. P. A. Rydberg, Curator, had charge of the collection of flowering plants. His monographic work for *North American Flora* was continued. The third part of the family Carduaceae was completed and has gone through the press. Work on the fourth part is in progress. Monographic work on the family Fabaceae, begun last year, resulted in the completion of manuscript more than sufficient for one part of the *Flora*. Dr. Rydberg also devoted some attention to the flora of the Rocky Mountains. Two papers were published during the year: viz. "Life Zones in the Rocky Mountains," in the *Memoirs of the New York Botanical Garden*, and "Phytogeographic Notes on the Rocky Mountain Region—VI.," in the *Bulletin of the Torrey Botanical Club*. Two other papers were written and will be issued early next year. In connection with monographic work for the *North American Flora*, Dr. Rydberg spent two weeks in study at the United States National Herbarium.

Dr. Marshall A. Howe, Curator, remained in charge of the collections of algae and hepaticae. Valuable additions to the stock of microtome sections of calcareous algae, sections that are most useful and necessary in critical studies of these plants, were made. Dr. Howe edited volume 6 of

the *Memoirs of the New York Botanical Garden*, consisting of the papers presented at the Garden's Twentieth Anniversary Celebration, September 6 to 11, 1915. The volume comprises 592 pages and 43 plates. In coöperation with Dr. Harold L. Lyon, Dr. Howe contributed a list of the algae of Palmyra Island to an account of the flora of this island published in Honolulu. In collaboration with Mr. F. S. Collins, he has published "Notes on Species of Halymenia," and, in collaboration with Dr. W. D. Hoyt, "Notes on some Marine Algae from the Vicinity of Beaufort, North Carolina." He has also published "A Note on the Structural Dimorphism of Sexual and Tetrasporic Plants of *Galaxuara obtusata*" and has prepared a paper on the calcareous algae of Murray Island, Australia, for publication by the Carnegie Institution of Washington. He continued to act as one of the editorial board of the Torrey Botanical Club, and gave two lectures in the Saturday afternoon lecture courses conducted by the Garden.

Dr. Fred J. Seaver, Curator, continued in charge of the fungous collections. A number of short papers were published, including a list of Bermuda fungi containing descriptions of three new species. The manuscript for one part of *North American Flora* was completed and a second part is well under way. The collecting of certain groups of fungi in the vicinity of New York was carried on during the summer and autumn. Some time was spent in collaboration with Mr. J. F. Stevenson in the preparation of a check list of Porto Rican fungi. Two lectures were given in the regular Saturday afternoon lecture course. Work on local insect pests was continued and one paper and several notes were published in the Garden *Journal* on this subject.

Mr. Percy Wilson, Associate Curator, was mainly occupied with herbarium work in determining and distributing specimens of West Indian plants. During February and March, he accompanied Dr. and Mrs. N. L. Britton to Cuba and to the Isle of Pines where a large and valuable

collection of botanical specimens was secured for the Garden. His duties as docent were performed as in former years. He also had charge of extra visiting classes from both public and private schools. The lantern-slide and negative collections, together with all photographic work, were under his supervision. On the excursions of the Torrey Botanical Club, Mr. Wilson who has been Chairman of the Field Committee for the past two years, obtained many specimens for the Local Flora collection.

Dr. Francis W. Pennell, Associate Curator, has devoted his attention mainly to the study of the species of Scrophulariaceae growing in the Rocky Mountain States. This interest, the ougrowth of his trip to that region in 1915, has been materially aided by the opportunity to examine most of the specimens from these states preserved in American herbaria. So far the greater part of his study has consisted in a revision of the genus *Pentstemon*, a genus which, because of its tendency to split into many species, each with small areas of distribution, has yielded data of especial phylogenetic and phytogeographic significance. During the past spring a revision, more or less tentative, was made of the Mexican genus *Eysenhardtia*. Dr. Pennell has published during the year several papers embodying earlier studies of southeastern plants. He has given two lectures in the Garden lecture courses. Since August he has had editorial supervision of the Garden *Journal*. During the past season, mostly upon vacation days or holidays, he has assisted in the task of building up a fuller working collection of the Local Flora; his efforts have added to this collection several thousand valuable specimens.

Miss Margaret Slosson, Assistant Curator, devoted her time to caring for the fern herbarium. She continued studies on different groups of the filmy ferns as in previous years and printed one paper on the genus *Trichomanes*.

Dr. H. H. Rusby, Honorary Curator of the Economic Collections, continued to develop the collections of the Economic Museum. See his report.

Mrs. N. L. Britton, Honorary Curator of Mosses, continued, with the coöperation of Mr. R. S. Williams, Administrative Assistant, to develop the moss herbarium. See her report.

Dr. Arthur Hollick, Honorary Curator of Fossil Plants, continued in charge of the paleontological collections. See his report.

The writer continued his general curatorial duties in connection with the public exhibits and the study collections and devoted available time to monographic work on *North American Flora.*

In continuation of the exploration of southern Florida, I visited for the most part either little-known or heretofore botanically unknown sections, both on the mainland and on the reef. An account of one trip was published in the *Journal* for November, and a report on the rest of the work is in preparation. In connection with the exploration referred to, two special collecting trips for cacti were made into northern Florida and into eastern South Carolina. As a culmination of some of our special investigations in southern Florida, a short history of Royal Palm Hammock was written and printed in the *Journal* for October. This paper was used in connection with the public dedicatory exercises of Royal Palm State Park in November.

Respectfully submitted,

J. K. Small,

Head Curator of the Museums and Herbarium.

REPORT OF THE HONORARY CURATOR OF THE ECONOMIC COLLECTIONS

Dr. N. L. Britton, Director-in-Chief.

Sir: I have the honor to submit the following report for the year 1916.

Seventy-eight specimens have been added to the economic collections, consisting chiefly of rare drug and food products obtained by myself, and of donations from outside sources.

Our most important addition has been that of a special case, located upon the southern wall of the western wing, and which beautifully displays the unique collection of Philippine fibers collected by Mr. Theodore Müller, and described in a previous report.

Progress has been made in the identification of the objects collected several years since by Messrs. Weiss and Schmidt on the upper Rio Negro.

It has been found necessary to store most of our accessions, owing to the almost complete exhaustion of our stock of museum jars. The replenishment of this supply during the coming year is urgently needed.

Respectfully submitted,

H. H. Rusby,

Honorary Curator of the Economic Collections.

REPORT OF THE HONORARY CURATOR OF MOSSES

Dr. N. L. Britton, Director-in-Chief.

Sir: During the year no purchases of mosses have been made; 600 specimens have been received in exchange and been incorporated in the herbarium, with the exception of the collections made by Dr. J. N. Rose in Brazil, some of which are still unnamed and include 180 specimens. Our exchanges have covered a wide territory, including North and South America, the West Indies, and 30 specimens (including 4 types) from Kerguelen Island received from M. Theriot. Brother Leon has continued his collections in Cuba, Mr. Stevenson in Porto Rico, and Mr. Harris in Jamaica. Special efforts have been made to dispose of some of the duplicates which have accumulated, during ten years, from the Mitten, Underwood, Howe, and Allen collections. Two thousand of these have been sent to thirty-five correspondents and the endeavor has been to place duplicates in the institutions located in or near the region where the specimens were collected. All exotic specimens have been sent to H. N. Dixon, who has very kindly consented to study all unnamed material, and

has published a paper on "New or Rare African Mosses from Mitten's Herbarium," etc., in the *Bulletin of the Torrey Club*,* with notes on others from New Zealand, Ceylon, and India in the *Journal of Botany*. Duplicates have also been sent during the year to Kew and the British Museum. Some South American specimens have been sent to Dr. Hicken, of Buenos Aires, and to Dr. Felippone, of Monte Video, and South American mosses have been exchanged and named by Mr. Williams for the National Museum. West Indian duplicates from each of the following islands have been returned to Cuba, Jamaica, Porto Rico, and Bermuda. Exchanges of North American species have been made with Cornell, Harvard, and Yale Universities, and with other correspondents located in ten different states. Contributions in duplicate have been made from the Allen and Howe collections to the sets of exsiccatae being issued by Dr. Grout and Professor Holzinger.

Dr. A. LeRoy Andrews has continued his cooperation for *North American Flora* and has received a large collection of critical or unnamed Bryums for study. Dr. Evans has also continued the investigation of our West Indian Hepaticae, and Miss Haynes has assisted with several small collections. Duplicates of our lichens from Porto Rico have been sent by Mr. Williams to Dr. Lincoln W. Riddle. Mr. George E. Kaiser has coöperated with us by naming various miscellaneous North American collections, including the set of Canadian arctic mosses collected by Mr. T. Johansen between Behring Straits and Coronation Gulf. Mr. R. S. Williams has begun on the large and troublesome family of Pottiaceae for *North American Flora* and I have continued my studies on *Fissidens*.

During the year, three additional essays on wild flowers needing protection, illustrated by the aid of the Stokes Fund, have been issued, and framed pictures including twelve colored plates have been sent to the Women's Farm and Garden Society and unframed pictures and literature

* Bull. Torrey Bot. Club **43**: 63–81. 1916.

to various schools and clubs. At the meeting of the Federation of Women's Clubs held in New York City in May, the Conservation Department held an exhibition, and the Stokes literature and work was shown and explained at that meeting. Several state organizations of Women have become interested and information supplied. Visits have also been made to several of the public schools and addresses given at commencement time to the scholars. A Junior Park League was organized and several thousand pledges, which read as follows, were signed by the children.

JUNIOR PARK LEAGUE

I promise,

To enjoy and use the parks more intelligently,
To love the flowers, the birds and all harmless wild creatures,
Not to pick flowers or break plants in any of the parks, and
Not to throw paper, glass or other rubbish about.

Name..... .... Teacher..... ... ..
Class. .. .. Principal.... ... .
Age. ..... Public School.... ... ...
Date. .....

The Garden Club of America and the International Garden Club have also joined in the efforts to protect our native plants, and Mr. Norman Taylor, who is now acting as Treasurer of the Wild Flower Preservation Society of America, has given addresses to various local garden clubs, using colored slides of our American wild flowers made by Miss Kittredge.

A state chapter has been organized in Pennsylvania by Professor Albert A. Hansen and a loan collection of colored slides prepared by Miss Kittredge had been sent to him for use at the Farmers' Institute, and the Pennsylvania State Chatauqua Circuits.

Several hundred copies of the following pledge have been supplied to various schools:

NEW YORK BOTANICAL GARDEN
Caroline and Olivia Phelps-Stokes Fund
for the
Preservation of Native Plants

I promise,
To protect our native plants,
Not to destroy rare wild-flowers and ferns,
Not to injure any shrub or tree, and
Not to set fire to the fields or woods.

Name. .....
Address. .....
Date. .....

Extra sets of the colored pictures for framing and the posters have been distributed; the surplus copies of my schedule for the Arbor Day compositions were sent to the Boston Society for the Protection of Our Native Plants, and an article for the second edition of Bailey's Encyclopedia of Horticulture was prepared for publication.

Respectfully submitted,
ELIZABETH G. BRITTON,
Honorary Curator of Mosses.

REPORT OF THE HONORARY CURATOR OF THE COLLECTION OF FOSSIL PLANTS

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to report as follows upon the activities in connection with the paleobotanical work at the Garden during the year 1916.

The cataloguing of type and figured specimens in the collections was completed and a list, arranged alphabetically by genera, together with a bibliography, was prepared by Mr. E. W. Humphreys, who acted as volunteer assistant from time to time during the year.

Work on the fossil flora of Alaska, in connection with the U. S. Geological Survey, was prosecuted during the months of April and May at Washington, D. C., and at the Garden whenever time was available.

About seventy specimens were added to the collections,

representing plants of Carboniferous, Tertiary, and Quaternary periods, and twenty-two volumes and pamphlets were added to the paleobotanical library.

The examination of unnamed material was continued and all specimens identified were properly labeled.

While in Washington, during May, on request of the Director-in-chief, it was my privilege to represent the Garden at the eleventh annual meeting of the American Association of Museums.

Respectfully submitted,

ARTHUR HOLLICK,
Honorary Curator of the Collection of Fossil Plants.

REPORT OF THE DIRECTOR OF THE LABORATORIES

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to submit the following report for the year 1916.

General Matters

There have been no changes during the year in the general arrangement of the laboratories and only rather few and minor additions to the equipment. Throughout most of the year the laboratory facilities were fully in use, and at times the supply of microscopes was not equal to the needs.

The facilities of the experimental plots and propagating greenhouses were fully utilized in connection with experimental studies in genetics and pathology carried on by members of the botanical department of Columbia University, by students of the Garden, and by myself.

Meteorological records have been taken as in previous years. As secretary of the monthly conferences of the staff and students of the Garden, I have arranged the programs and prepared the reports of such conferences which have been published in the *Journal*. I also continued as editor of the *Journal* until the August issue.

Personal Investigations

The most intensive as well as extensive studies of the year have been directed to various lines of investigation with *Cichorium Intybus*. The results of the previous years' study on the self- and cross-compatibilities and incompatibilities revealed in fertility and sterility were published in August in the *Memoirs of the New York Botanical Garden*, volume 6. During the past summer these studies have been vigorously prosecuted with a later generation of pedigreed cultures. About 5,500 controlled self-pollinations were made on as many heads of 549 plants and the results of seed production determined. A considerable number of cross-pollinations was also made. Much data were also obtained from these cultures on the isolation of vegetative types by pure line breeding, on the heredity of flower-color, and on the behavior of fasciation.

The cultures of chicory were also utilized for a continuation of a statistical study of flower-number, which has now been continuously prosecuted for five years. A total of 515 plants were involved in these studies during 1916. In obtaining these data, Miss Helene M. Boas, Mr. M. V. Reed, and the writer coöperated. The granting of a scholarship for two months to Mr. Reed made his participation in these studies possible and thereby greatly facilitated their progress. Miss Boas has continued as laboratory assistant during the year and a considerable portion of her time has been taken in collecting and compiling the data. She will collaborate with me in the publication of the results, and the manuscript for such publication is now in preparation.

New cultures of *Hibiscus* have been grown and considerable data obtained bearing on the polymorphism of *Hibiscus Moscheutos*, on the general heredity of *H. oculiroseus* (especially of the dwarf form), and of the variation resulting among the progeny of various varietal and specific hybrids. The development of internal flowers (rudimentary flowers enclosed in the pistil and pod) in *H. oculiroseus*

and in various hybrids with this species as a parent has been studied with reference to the influence on fertility. Field studies on the natural distribution of *Hibiscus* were deferred until another year, but correspondence with various botanists have revealed conditions that make such studies desirous, if not imperative, to the further prosecution of this research. It is also highly desirable to grow further cultures that will enlarge the area of the *Hibiscus* plantation.

Cultures of *Verbascum Blattaria* have been grown for further study of the heredity of flower-color and of the conditions inducing fasciation. These cultures have also been utilized for certain observations on phyllotaxy.

Some progress has been made in the cytological study of the various forms of *Plantago lanceolata* with reference to the various grades of sex differentiation that here appear, and of *Cichorium Intybus* with respect to the behavior of pollen-tubes in cases of self-sterility and self-fertility.

The hybrids between various species of *Carex*, noted in previous reports, bloomed profusely this year and seeds were obtained for an F_2 generation. Herbarium specimens were made for record and for study by specialists on *Carex*.

Observations on variations appearing in tulips have been continued. Experiments have also been started to determine the relation in tulips of the weight of bulbs to flowering and to depth of planting. Definite studies are also being made in pedigreed cultures on the behavior of tulip plants that came "blind" last year.

Students and Investigators

Professor Gies and Dr. Horowitz have continued to make chemical investigations of various plant pigments, especially those of certain flowers and of the leaves of *Coleus*, material for which has been supplied from the Garden.

Several visiting investigators have been in residence during a part of the year. Professor G. E. Stone spent several months in physiological researches. Dr. R. R.

Gates spent a few weeks in cytological research. Professor John W. Ritchie, now in the city on a leave of absence from the College of William and Mary, has begun various lines of study involved in apogamy. You have recently granted Dr. Henri Hus permission to utilize the facilities of the institution for his investigation of *Hevea*. Professor R. A. Harper has continued his studies on heredity in corn. Mr. Raines has pursued studies of rust infection on various cereals grown for this purpose. Numerous investigators not named above have been at the Garden for various periods of time prosecuting lines of research especially in connection with the study of herbarium material.

The following list includes only those students duly registered at the Garden. Only one of these, Mr. Reed, was the recipient of a scholarship; all others have pursued studies for degrees and have paid tuition either at the Garden or at Columbia University, or during their period of study have been members of the botanical staff at Columbia University.

ALTENBERG, EDGAR. Ph.D., Columbia Univ., 16. Since September on the faculty of Rice Institute.
Heredity in Primula.

BARBOUR, WILLIAM CLAY. B.S.
Lichenology.

BERMAN, FLORENCE JULIA. A.B., Teacher in Public School 10, New York City.
Cellular relations in variegated plants.

DARROW, ISABELLE CAROLINE. A.B. (Mrs. Ralph R. Stewart).
Fertility in Ammocallis.

GRAFF, PAUL WEIDEMEYER. M.A., Columbia Univ., 16. Instructor in Botany, Univ. of Montana, since September.
Pathology.

HAZEN, ELIZABETH LEE. B.S.
Studies of fertility in Ammocallis.

NIXON, ERNST LELAND. M.S., Assistant in botany, Columbia Univ.
Genetics.

ORTON, CLAYTON ROBERTS. M.S.
Mycology.
ROUTT, GROVER CLEVELAND. M.S. Tobacco inspector and Supt. of farms, Harrow Tobacco Station, Canada.
Genetics. Pathology.
REED, MERRIL VIRGIL. A.B.
Genetics.
STEWART, RALPH RANDLES. Ph.D., Columbia Univ., '16.
Taxonomy of the phanerogams of western Tibet.
STOWELL, WILLARD ALLEN. B.S., Instructor of Science, High School, Elizabeth, New Jersey.
The black oaks of Cliffwood, New Jersey.
TAISTRA, SOPHIE AMY. B.A., Assistant teacher in biology, High School of Commerce, New York City.
Genetics. Cytology.
YAMPOLSKY, CECIL. B.S. Assistant in botany, Columbia Univ.
Genetics. Cytology.

As noted above, degrees have been granted during the year by Columbia University to three of these students. Miss Darrow completed her thesis for the degree of M.A., which will be granted in February. Mr. Stowell has also completed, during the year, the studies necessary for a thesis for the degree of M.A.

Respectfully submitted,

A. B. STOUT,
Director of the Laboratories.

REPORT OF THE BIBLIOGRAPHER

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to submit the following report for the year 1916.

The customary work of bibliographic correspondence, and of advice to those consulting the library, has been performed throughout the year; it consumes much time, but seems to be appreciated, and such service is unquestionably valuable in increasing the popularity of the Garden.

Few purchases have been made for the library, and the

need of greater development of this branch of equipment is increasing. The book market is still in a demoralized condition on account of the European conflict, but several thousand dollars could be expended advantageously in the purchase of books for the library even under existing circumstances.

Five parts of *North American Flora*, aggregating 448 pages, have been issued during the year: Volume 9, Part 5, in June, Volume 9, Parts 6 and 7, in October, Volume 21, Part 1, in November, and Volume 34, Part 3, in December. Another part is in press. The issue of Part 7, completing Volume 9, was a noteworthy event in the history of this publication, as this is thus the first volume to be finished (see the November number of the *Journal*).

The new periodical provided for by the will of the late president of the Garden, Judge Addison Brown, comprising colored illustrations of plants, each accompanied by text written in popular language, was launched this year as a quarterly publication. One volume of *Addisonia*, of four numbers each containing ten plates, has appeared, under the editorship of the Bibliographer and Head Gardener. Its reception by the public has been very gratifying, the number of subscriptions already amounting to 220.

The Bibliographer has continued his work upon the literature of botany, and his taxonomic studies. His paper presented at the anniversary celebration last year, "Segregation of genera in Lentibulariaceae," was published in the sixth volume of the *Memoirs*, in September of this year; and he contributed to Volume 9 of *North American Flora* a 32-page bibliography recording all the authors, books, and papers cited in that volume. He also gave a lecture in the public summer course of the Garden.

Respectfully submitted,

JOHN HENDLEY BARNHART,
Bibliographer.

REPORT OF THE LIBRARIAN

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to submit the following report for the year 1916.

According to a census of the library taken at the end of the year, the number of bound volumes was found to be 27,639, an increase of 415 volumes since the report for 1915.

During the year 266 books have been bound, including 24 which are the property of Columbia University, while 74 have been rebound.

Among the accessions are 48 books acquired by purchase, and 70 by exchange and deposit. There have been 112 gifts. Columbia University has permanently recalled 39 of her books.

The cataloguing is now kept practically up to date. There have been added to the catalogue during the past year 1,104 written and typewritten cards, in addition to the printed cards issued by the Torrey Botanical Club. A beginning has been made upon the revision of the catalogue. The work thus far done consists chiefly in the extension and correlation of the subject headings, together with the supplying of biographical data. Very much remains to be done.

In the spring, a persistent effort was made to complete the files of Agricultural Experiment Station publications, with gratifying results in many cases, though some of the earlier numbers are still lacking.

During the year the labels upon the books throughout the library have been renewed where necessary.

In October there was made through the Department of State, and with the endorsement of the Librarian of Congress, an application for a permit for the shipment to the United States of certain of our periodicals which are detained at Rotterdam. The latest information from Washington states that a representative of the Library of Congress will sail for Rotterdam early in January, and "will lend his good offices in securing prompt inspection of the

material and in reporting difficulties connected with any particular shipment."

Since a complete list of the periodicals received currently by the Garden has not been printed since the report of the Librarian for 1910 (*Bulletin* 7: 325–347), it seems advisable that such a list should be appended to the present report.

The work of revision, including the large amount of correspondence involved, has occupied the major portion of my time since the early part of October. Owing to the war, it has been impossible to receive information regarding certain of the periodicals, while others are known to have temporarily suspended publication. It is possible that a few of the former should be omitted from the list.

Respectfully submitted,

SARAH H. HARLOW,
Librarian.

LIST OF PERIODICALS

* Periodicals subscribed for by the Garden.

† Periodicals subscribed for by Columbia University and deposited at the Garden.

‡ Periodicals received in exchange by the Torrey Botanical Club and deposited at the Garden.

§ Periodicals whose publication is temporarily suspended, or which are delayed in transmission.

All others are received in exchange by the Garden.

Agricultural Experiment Station, Auburn, Ala. [*Publications.*]
" " " Tuskegee, Ala. "
" " " Sitka, Alaska. "
" " " Tucson, Ariz. "
" " " Fayetteville, Ark. "
" " " Berkeley, Calif. "
" " " Fort Collins, Colo. "
" " " New Haven, Conn. "
" " " Storrs, Conn. "
" " " Newark, Del. "
" " " Gainesville, Fla. "
" " " Experiment, Ga. "
" " " Guam. "
" " " Honolulu, Hawaii. "

Agricultural Experiment Station, Moscow, Ida. [*Publications.*]
" " " Urbana, Ill. "
" " " Lafayette, Ind. "
" " " Ames, Iowa. "
" " " Manhattan, Kan. "
" " " Lexington, Ky. "
" " " Baton Rouge, La. "
" " " Orono, Me. "
" " " College Park, Md. "
" " " Amherst, Mass. "
" " " East Lansing, Mich. "
" " " University Farm, St. Paul, Minn. "
" " " Agricultural College, Miss. "
" " " Columbia, Mo. "
" " " Bozeman, Mont. "
" " " Lincoln, Neb. "
" " " Reno, Nev. "
" " " Durham, N. H. "
" " " New Brunswick, N. J. "
" " " State College, N. M. "
" " " Geneva, N. Y. "
" " " Ithaca, N. Y. "
" " " Raleigh, N. C. "
" " " Agricultural College, N. D. "
" " " Wooster, Ohio. "
" " " Stillwater, Okla. "
" " " Corvallis, Ore. "
" " " State College, Pa. "
" " " Mayagüez, Porto Rico, W. I. "
" " " Kingston, R. I. "
" " " Clemson College, S. C. "
" " " Brookings, S. Dak. "
" " " Knoxville, Tenn. "
" " " College Station, Tex. "
" " " Logan, Utah. "
" " " Burlington, Vt. "
" " " Blacksburg, Va. "

Agricultural Experiment Station, Pullman, Wash. [*Publications.*]
" " " Morgantown, W. Va. "
" " " Madison, Wis. "
" " " Laramie, Wyo. "
Agricultural Gazette of New South Wales, Sydney, N. S. W.
Agriculture Pratique des Pays Chauds: see L'Agriculture Pratique des Pays Chauds.
Alabama. Geological Survey, University, Ala. *Bulletin, Report, Monograph.*
A Lavoura; see Sociedade Nacional de Agricultura, Rio de Janeiro.
Algiers. Société d'Histoire Naturelle de l'Afrique du Nord, Algiers, Algeria. *Bulletin.*
§†Allgemeine Botanische Zeitschrift, Karlsruhe, Germany.
Alumni Journal, College of Pharmacy, New York, N. Y.
§Amani. Biologisch-Landwirtschaftliches Institut, Hafen Tanga, Deutsch-Ost-Afrika. *Der Pflanzer.*
Amateur des Champignons: see L'Amateur des Champignons.
America. Botanical Society: see Botanical Society of America.
America. Society of American Florists: see Society of American Florists.
American Academy of Arts and Sciences, Boston, Mass. *Proceedings.*
American Association for the Advancement of Science, Washington, D. C. *Proceedings.*
*American Botanist, Joliet, Ill.
*American Fern Journal, Auburndale, Mass.
American Florist, Chicago, Ill.
American Forestry, Washington, D. C.
American Genetic Association: see Journal of Heredity.
American Journal of Botany, Lancaster, Pa.
American Journal of Pharmacy, Philadelphia, Pa.
American Journal of Science, New Haven, Conn.
American Midland Naturalist, Notre Dame, Ind.
American Museum of Natural History, New York, N. Y. *Bulletin, Report. Journal.*
‡American Naturalist, Lancaster, Pa.
American Philosophical Society, Philadelphia, Pa. *Proceedings.*
American Rose Society, Harrisburg, Pa. *American Rose Annual.*

Amsterdam. Koloniaal Institut, Amsterdam, Holland. *Jaarverslag*, [*Publications*.]
†Annales des Sciences Naturelles: Botanique; Paris, France.
§Annales Mycologici, Berlin, Germany.
Annali di Botanica, Rome, Italy.
*Annals of Applied Biology, Cambridge, England.
*Annals of Botany, London, England.
Annals of the Bolus Herbarium; see Bolus Herbarium.
§Antwerp. Jardin Botanique, Antwerp, Belgium. *Seed Lists.*
Appalachian Mountain Club, Boston, Mass. *Appalachia.*
*Arborea. Worcester, Mass.
§*Archiv der Pharmazie, Berlin, Germany.
§*Archiv für Zellforschung, Leipzig, Germany.
§Ardennes. Société d'Histoire Naturelle, Charleville, France. *Bulletin.*
Argentina. Sociedad Cientifica Argentina; see Sociedad Cientifica Argentina.
Arkiv för Botanik: Stockholm, Sweden.
Arnold Arboretum, Jamaica Plain, Mass. *Bulletin of Popular Information.*
Asiatic Society of Bengal, Calcutta, India. *Journal.*
*Association Française pour l'Avancement des Sciences, Paris, France. *Compte Rendu.*
§Augsburg. Naturwissenschaftlicher Verein fur Schwaben und Neuburg (a.V.), Augsburg, Germany. *Bericht.*
Baltimore. City Forester, Baltimore, Md. *Annual Report.*
Barcelona. Junta de Ciencies Naturals, Barcelona, Spain. *Anuari.*
Basel. Naturforschende Gesellschaft, Basel, Switzerland. *Verhandlungen.*
§Bavaria. Bayerische Gesellschaft zur Erforschung der heimischen Flora. Munich, Bavaria. *Berichte. Mitteilungen.*
§Belgium. Société Royal de Botanique de Belgique. Brussels, Belgium. *Bulletin.*
Bengal. Asiatic Society: see Asiatic Society of Bengal.
Bergen's Museum, Bergen, Norway. *Aarbok.*
Bergianska Trādgården, Stockholm, Sweden. *Acta Horti Bergiani.*
§‡Berlin. Königlicher Botanischer Garten, Berlin, Germany. *Notizblatt.*

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Toronto. University of Toronto, Canada. *Studies; Anatomical Series, Biological Series, Geological Series, Pathological Series, Physiological Series.*

Torrey Botanical Club, New York, N. Y. *Bulletin, Memoirs, Torreya.*

Trajectum: see Utrecht.

Tree Talk, Stamford, Conn.

Trinidad. Agricultural Society of Trinidad and Tobago, Trinidad, W. I. *Proceedings.*

Trinity College, Dublin, Ireland. *Notes from the Botanical School.*

Tromsø Museum, Tromsø, Norway. *Aarshefter, Aarsberetning.*

Union of South Africa: see South Africa, Union of South Africa.

United Empire: see London, Royal Colonial Institute.

United States Department of Agriculture, Washington, D. C. *All Publications.*

United States Geological Survey, Washington, D. C. *Bulletin, Annual Report, Monographs, Professional Papers.*

United States National Museum: see Smithsonian Institution, United States National Museum.

Upsala. Kgl. Universitat, Upsala, Sweden. *Botanical Reprints, Seed Lists.*

Upsala. Regia Societas Scientiarum Upsaliensis, Upsala, Sweden. *Nova Acta.*

Utrecht. Hortus Botanicus Universitatis Rheno-Traiectinae, Utrecht, Holland. *Seed Lists.*

Valais. La Murithienne, Société Valaisanne des Sciences Naturelles, Sion, Valais, Switzerland. *Bulletin.*

Valencia. Universidad Literaria de Valencia, Valencia, Spain. *Seed Lists.*

Vermont. Commissioner of Agriculture, Burlington, Vt. *Annual Report.*

Victoria. Department of Agriculture, Melbourne, Victoria. *Journal.*

Victoria. Field Naturalists' Club of Victoria, Melbourne, Australia. *The Victorian Naturalist.*

§*Vienna. K. K. Zoologisch-Botanische Gesellschaft, Vienna, Austria. *Abhandlungen.*

§‡Vienna. K. K. Zoologisch-Botanische Gesellschaft, Vienna, Austria. *Verhandlungen.*

Wageningen. Rijks Hoogere Land-, Tuin- en Boschbouwschool, Wageningen, Holland. *Mededeelingen.*

Washington. Biological Society of Washington, Washington, D. C. *Proceedings.*

Washington. Library of Congress, Washington, D. C. *Report.*

Wellcome Chemical Research Laboratories, London, England. *Papers.*

Wellington Field Naturalists' Club, Journal: see Ontario Natural Science Bulletin.

West American Scientist, San Diego, Cal.

West Indies. Agricultural Department, Barbadoes, W. I. *Bulletin, Agricultural News.*

West Indies. Inspectie van den Landbouw in West Indië, Paramaribo, Dutch Guiana. *Bulletin, Verslag.*

West Java. Proefstation voor Suikerriet: see Java, Proefstation,

Wild Flower Preservation Society of America, New York, N. Y. *Circulars.*

Wisconsin Academy of Arts and Sciences, Madison, Wis. *Transactions.*

Wisconsin Natural History Society, Milwaukee Public Museum. Milwaukee, Wis. *Proceedings.*

Wisconsin. University of, Madison, Wis. *Bulletin, Science Series.*

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§*Zeitschrift für Botanik, Jena, Germany.

§*Zeitschrift für induktive Abstammungs- und Vererbungslehre, Berlin, Germany.

§†Zeitschrift fur Pflanzenkrankheiten, Stuttgart, Germany.
§*Zeitschrift fur Physiologische Chemie, Strassburg, Germany.
§*Zeitschrift fur Wissenschaftliche Mikroskopie, Brunswick, Germany.
Zürich. Naturforschende Gesellschaft, Zürich, Switzerland. *Vierteljahrsschrift.*

REPORT OF THE SUPERINTENDENT OF BUILDINGS AND GROUNDS

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to submit the following report as Superintendent of Buildings and Grounds for the year 1916.

Regulating and Grading

Most of this work was done at the rose garden, convention garden, and the iris garden. We regulated, graded, and made ready for planting 15 × 200 feet along Pelham Avenue and 15 × 180 feet along the Southern Boulevard. More than three-quarters of the rose garden is regulated, graded, and ready for planting. About an acre of ground between the large lake and the eastern boundary line of the Garden, to be used for the instruction of school teachers in gardening, has been cleared and plowed.

Contractors who were excavating cellars in the vicinity of the Garden and who were looking for a convenient place to dispose of the soil have carted 11,000 cubic yards of earth into the grounds, depositing it to our satisfaction at their expense. About 1,000 yards of this soil has been placed at the quarry near the iris garden, 3,000 yards north of the Woodlawn Avenue approach, and 7,000 yards at the northern end of the large lake near the rose garden for filling in the new road.

From paths now under construction at the convention garden, along Pelham Avenue, and through the Magnolia collection, 3,200 cubic yards of top-soil were transferred to the rose garden. For the purpose of filling in the new road at the northern end of the large lake, 2,000 yards of fill were removed by our carts from the bank on the northern side of this road.

Drainage

Two catch-basins, 80 feet of 6-inch drainage pipe, and 100 feet of 3-inch porous pipe have been placed at the iris garden for drainage. To drain the lowland in the north meadow, 100 feet of 4-inch drain pipe have been used. We placed 44 feet of 15-inch pipe under the roadway to drain the convention garden, and built three catch-basins and laid 60 feet of 4-inch pipe to drain the rose garden.

Roads and Paths

All the roads throughout the grounds were tarred and covered with grit by the Park Department. We have completed 716 feet of 10-foot paths at the iris garden. On the western side of the Bronx River, a path 300 feet long and 10 feet wide has been lined and is now ready to be paved. We have lined and made ready for paving 2,305 feet of 10-foot paths running through the convention garden to the iris garden. The stone used for the construction of the paths west of the Bronx River was taken from the quarry near the museum building. We have lined and made ready for paving 1,035 feet of a 10-foot path outside the rose garden boundary and 1,123 feet of a path 8 feet wide on the inside of this boundary. Paths from the elevated railway approach to conservatory range 1, all the paths around the terrace of conservatory range 1, and paths leading from conservatory range 2 to the Allerton Avenue entrance have been screened.

Buildings

Considerable repairs were made throughout the Garden during the year by our mechanics. The carpenters replaced several rafters in the dome and in houses 4, 13, 14, and 15 of conservatory range 1, and repaired all the ventilating sash. A workshop has been constructed in the north runway of power house 1, and one wall exhibition case twenty feet long was built for the main floor of the museum building. The cedar fence south of the herbaceous

grounds has been removed and is now being used for the erection of a fence along the Southern Boulevard. Posts for this fence have been set for a distance of 900 feet. The western porch of the mansion has been rebuilt and numerous repairs were made to the doors and closets. Considerable repairing has been done in the museum building, comfort stations, and the stable.

The main and rear hallways of the mansion and all the pipe fence through the hemlock grove have been painted. The exterior of houses 1, 12, 13, 14, and 15 and all doors on the interior of conservatory range 1 were painted. Thirty signs for the direction of visitors and for the protection of the grounds and shrubbery have been repainted and lettered. All broken glass in conservatory ranges 1 and 2 and in the propagating houses has been replaced.

Necessary repairs to the plumbing system throughout the buildings were made by our men. The fountains, water system, steam system, and two large patches in the roof of the museum building were repaired. A concrete bench 80 feet long was constructed in house 5 of conservatory range 1. During the summer, the following repairs were made in power house 1 by contractors: a blower system was installed in the five boilers and small-sized grates in boilers 3, 4, and 5, in which we are now burning buckwheat coal, were also installed. We are using No. 2 nut coal in boilers 1 and 2. 117 tubes were replaced in the boilers. Numerous repairs were made in the power houses and conservatories by our steam engineers.

Grounds

In addition to our own guards, on Saturdays, Sundays, and holidays from the last Sunday in May to the last Sunday in August, the Garden was patrolled by five uniformed city officers and two detectives, who successfully enforced the park ordinances relative to the destruction of shrubbery, scattering of paper, and general vandalism. About 80 arrests were made and the offenders were fined from one to

ten dollars. Owing to the vigilance of the city officers and our employees, the damage to the lawns and plantations was very slight. On Sundays and holidays during the warm weather, the visitors to the Garden numbered about 40,000. This number was increased to nearly 50,000 during July and August. The number of visitors to the museums and conservatories has greatly increased over that of other years.

We have cut down about 75 dead trees. The gasoline engine was kept running for two weeks and a half, and sufficient wood was cut to supply fuel for the propagating houses for five months. We have continued to uproot the poison ivy throughout the grounds with very satisfactory results. The work will be continued each year until the ivy is exterminated.

One cart was purchased. About 40 tons of hay were cut during the summer and have been put in the two barracks.

Respectfully submitted,

ARTHUR J. CORBETT,

Superintendent of Buildings and Grounds.

SCHEDULE OF EXPENDITURES DURING THE YEAR 1916

1. CITY MAINTENANCE ACCOUNT

Appropriated $100,075.00

Expended

Personal Service

Salaries	$ 79,263.66	
Labor	2,451.50	
Total		$ 81,715.16

Sundry Expenses

Forage	$ 834.01	
Fuel	10,089.58	
Supplies	1,043.13	
Equipment	2,150.66	
Materials	2,046.70	
Repairs	1,358.70	
Telephone Service	170.22	
Contingencies	666.84	
Total		$ 18,359.84
Total Expended		$100,075.00

2. SPECIAL GARDEN ACCOUNTS

Exploration Fund

1901 to 1914. Subscriptions	$ 37,028.45	
Sales and Refunds	1,669.06	
Total		$ 38,697.51
1901 to 1914. Expended		38,673.46
Balance		*$ 24.05*

Museum and Herbarium Fund

1901 to 1914. Subscriptions	$ 11,895.00	
Sales and Refunds	387.89	
1916. Subscriptions	500.00	
Total		$ 12,782.89
1901 to 1913. Expended	$ 12,263.99	
1916. Expended	447.00	
Total		$ 12,710.99
Balance		*$ 71.90*

Plant Fund (Conservatory Fund)

1900 to 1914. Subscriptions	$ 9,576.55	
Sales and Refunds	689.16	
1916. Sales	98.50	
Total		$ 10,364.21

1900 to 1915. Expended	10,232.54	
1916. Expended	119.60	
Total		$ 10,352.14
Balance		$ *12.07*

SPECIAL BOOK FUND

1899 to 1914. Subscriptions	$ 31,547.88	
Sales and Refunds	121.48	
1916. Subscriptions	25.00	
Total		$ 31,694.36
1899 to 1915. Expended	$ 31,638.17	
1916. Expended	6.45	
Total		$ 31,644.62
Balance		$ *49.74*

GARDEN EXTENSION AND COMMEMORATION FUND

January 10, 1916. Balance	$ *.57*
December 29, 1916. Transferred to Rose Garden and Garden Extension Fund	*.57*

PUBLIC LECTURE FUND

1916. Subscriptions		$ 550.00
1916. Expended		430.53
Balance		$ *119.47*

ROSE GARDEN AND GARDEN EXTENSION FUND.

1916. Subscriptions	$ 8,400.00	
December 29, 1916. Transferred from Garden Extension and Commemoration Fund	.57	
Total		$ 8,400.57
1916. Expended.		
Salaries	$ 2,200.00	
Labor	4,853.50	
Plans	839.07	
Supplies and Materials	492.53	
Total		$ 8,385.10
Balance		$ *15.47*

SUMMARY OF SPECIAL GARDEN ACCOUNTS

Subscriptions

1899 to 1915	$105,479.88	
1916	9,475.00	

Sales and Refunds

1899 to 1915	$ 2,867.59	
1916	98.50	
Total		$117,920.97

Expended

1899 to 1915	$108,239.59	
1916	9,388.68	
Total		$117,628.27
Balance		$ *292.70*

3. SPECIAL INCOME ACCOUNTS

	Appropriated	*Expended*	*Balances*
Income of Science and Education Fund.			
Publications		$ 1,551.35	
Lectures		317.77	
Photography		454.04	
Laboratories		837.80	
Exploration		439.02	
Total	$ 3,700.00	$ 3,599.98	$ *100.02*
Income of Darius Ogden Mills Fund.			
Museums		$ 645.59	
Herbarium		584.91	
Books and Binding		659.70	
Investigations at other Institutions		107.75	
Total	$ 2,000.00	$ 1,997.95	$ *2.05*
Income of Henry Iden Fund.			
Resident Research Scholarships		$ 100.00	
Books		298.75	
Total	$ 400.00	$ 398.75	$ *1.25*
Income of William R. Sands Fund.			
Horticultural Prizes	$ 400.00	$ 378.00	$ *22.00*
Accumulated Income of Olivia E. and Caroline Phelps Stokes Fund.			
For the Preservation of Native Plants	$ 300.00	$ 279.13	$ *20.87*
Accumulated Income of Students Research Fund.			
Aid for Students Research	$ 200.00	———	$ *200.00*
Income of David Lydig Fund.			
Publications	$ 5,200.00	$ 5,198.38	$ *1.62*
Accumulated Income of Addison Brown Fund.			
For Colored Illustrations of Plants.			
Salary of Artist		$ 300.00	
Printing and Stationery		2,870.59	
Total	$ 4,200.00	$ 3,170.59	$ *1,029.41*
Accumulated Income of John Innes Kane Fund.			
For Plants for Grounds and Greenhouses	$ 600.00	$ 598.94	$ *1.06*
Income of Maria DeWitt Jesup Fund.			
For Increase of the Collections.			
Books		$ 120.04	
Specimens		411.04	
Plants		81.69	
Total	$ 800.00	$ 612.77	$ *187.23*
Accumulated Income of Charles Budd Robinson Fund.			
For aiding Exploration	$ 40.00	———	$ *40.00*
Totals—Special Income Accounts	$ 17,840.00	$ 16,234.49	$ *1,605.51*

4. GENERAL INCOME ACCOUNT

	Appropriated including Transfer	*Expended*	*Balances*
INSURANCE			
Museum Specimens and Library		$ 366.60	
Boilers and Elevator		111.00	
Glass in Conservatories		142.25	
Horses and Wagons		12.50	
Total	$ 650.00	$ 632.35	$ *17.65*
SUPPLIES (INCLUDING CIRCULARS FOR MEMBERSHIP)			
Circulars for Membership		$ 343.12	
Supplies		850.44	
Total	$ 1,200.00	$ 1,193.56	$ *6.44*
Contingent Fund	1,100.00	1,061.65	*38.35*
ENTERTAINMENT			
Refreshments		$ 200.00	
Hire of Touring Cars		102.50	
Printing and Stationery		281.00	
Total	$ 600.00	$ 583.50	$ *16.50*
Assistance for Treasurer	480.00	480.00	
SALARIES			
Individual Accounts		$ 12,735.00	
Museum Aids		434.67	
Gardeners and Apprentices		2,921.17	
Miscellaneous		804.67	
Total	$ 16,900.00	$ 16,895.51	$ *4.49*
LABOR			
Weekly Pay Rolls		$ 3,860.00	
Guard Duty		452.25	
Miscellaneous overtime		285.25	
Total	$ 4,600.00	$ 4,597.50	$ *2.50*
Totals—General Income Account	$ 25,530.00	$ 25,444.07	$ *85.93*

5. EXPENDED FROM FUNDS OF THE GARDEN

Special Garden Accounts, 1916	$ 9,388.68
Special Income Accounts	16,234.49
General Income Account	25,444.07
Total	$ 51,067.24

6. BOARD ROOM FUND

Total Receipts from April 12 to December 31, 1916	$103.85	
Less—Credited to Income of Lydig Fund	*5.05*	
Net Total Receipts		$98.80

Disbursements		
Supplies and Materials	$ 60.85	
Contingencies	6.78	
Total		$67.63
Dec. 31, 1916. Balance—Cash		*$31.17*

Respectfully submitted,

WALTER S. GROESBECK,

Accountant.

E. and O. E.

NEW YORK, January 8, 1917.

SUBSCRIPTIONS TO THE ROSE GARDEN AND GARDEN EXTENSION FUND

Mr. Fritz Achelis	$ 25
Mr. Edward D. Adams	100
Mrs. James Herman Aldrich	25
Mr. A. H. Anderson	10
Mr. John D. Archbold	100
Mrs. George A. Archer	25
Mr. Edward W. C. Arnold	25
Mrs. Hugh D. Auchincloss	50
Mr. Samuel P. Avery	25
Mrs. Robert Bacon	100
Mr. George F. Baker	100
Mrs. Thomas H. Barber	25
Mr. Alfred N. Beadleston	25
Mr. Eugene P. Bicknell	15
Miss Elizabeth Billings	25
Mr. George Blumenthal	25
Mr. John I. D. Bristol	5
Dr. N. L. Britton	500
Mr. Andrew Carnegie	250
Dr. Walter F. Chappell	10
Hon. W. A. Clark	25
Col. Samuel P. Colt	50
Mrs. F. A. Constable	25
Mr. James W. Cromwell	50
Mr. Charles Deering	100
Mr. Eugene Delano	100
Mrs. Charles D. Dickey	25
Mr. Cleveland H. Dodge	200

Dr. James Douglas	200
Mr. A. F. Estabrook	25
Mr. James B. Ford	250
Mr. Henry W. de Forest	50
Dr. Robert W. de Forest	50
Miss Susan D. Griffith	10
Mr. Daniel Guggenheim	500
Mrs. William Pierson Hamilton	25
Mr. Edward S. Harkness	500
Mrs. Frank D. Harmon	10
Mrs. E. H. Harriman	100
Mr. T. A. Havemeyer	100
Miss Caroline C. Haynes	25
Mr. A. Heckscher	100
Mrs. H. P. Hodson	10
Mr. Bernhard Hoffmann	25
Mr. Henry R. Hoyt	100
Mr. Theodore R. Hoyt	25
Mrs. Richard Irvin	5
Dr. Walter B. James	50
Miss Annie B. Jennings	50
Mr. Walter B. Jennings	100
Mrs. Hamilton Fish Kean	25
Mrs. John S. Kennedy	50
Mr. Edward V. Z. Lane	50
Mr. Lewis H. Lapham	100
Professor and Mrs. Frederic S. Lee	100
Mr. Adolph Lewisohn	25
Mrs. V. Everit Macy	25
Mrs. Henry Marquand	25
Mr. Edgar L. Marston	25
Mr. William J. Matheson	50
Mr. James McLean	100
Mr. Emerson McMillin	100
Mr. Ogden Mills	250
Mr. J. P. Morgan	250
Dr. Lewis Rutherfurd Morris	25
Mr. John P. Munn	10
Mr. Frederic R. Newbold	25
Mr. E. E. Olcott	25
Mr. James C. Parrish	25

Mr. George W. Perkins	250
Mrs. George W. Perkins	250
Mr. William H. Perkins	25
Mr. Charles F. Rand	100
Miss Emily Redmond	25
Mr. Edwin A. Richard	150
Miss Elvine Richard	50
Mr. John J. Riker	50
Mr. William J. Riker	25
Dr. William C. Rives	25
Mr. William Rockefeller	100
Mrs. James Roosevelt	25
Mrs. Archibald D. Russell	100
Mr. Mortimer L. Schiff	200
Miss Grace Scoville	25
Mr. James A. Scrymser	50
Mr. Isaac N. Seligman	25
Mr. A. R. Shattuck	25
Mrs. Finley J. Shepard	25
Mr. William Shillaber	25
Mrs. Alfred L. Simon	10
Mrs. Benson B. Sloan	25
Mr. William Sloane	25
Mr. Francis Lynde Stetson	250
Miss Ellen J. Stone	25
Mr. Frederick Strauss	25
Mr. F. K. Sturgis	50
Mrs. Henry O. Taylor	100
Mr. B. B. Thayer	25
Mr. Charles G. Thompson	50
Mrs. F. F. Thompson	25
Mr. William B. Thompson	100
Mr. Myles Tierney	100
Mr. Louis C. Tiffany	100
Mr. W. K. Vanderbilt	250
Mrs. William Young Westervelt	5
Mr. H. H. Westinghouse	25
Anonymous	25
Total	$8,400

REPORT OF THE CHAIRMAN OF THE SCIENTIFIC DIRECTORS

(*Received and ordered printed, January 8, 1917*)

To the Board of Managers of the New York Botanical Garden.

Gentlemen: I have the honor to submit below the report of the Scientific Directors for the year 1916.

As a result of a change in the City administration, Hon. William G. Willcox has succeeded Hon. Thomas W. Churchill as ex-officio member of our Board.

Professor William H. Carpenter, Provost of Columbia University, has continued to represent President Nicholas Murray Butler at our meetings.

Owing to the continued incapacity of Professor James F. Kemp, through illness, we have authorized his professional representative, Professor Charles P. Berkey, to meet with us.

Our meetings have been held regularly and the year has been an active one, rather more than the usual number of important matters having come before us for consideration. Among these subjects, those of an educational character have predominated.

During the latter part of 1915, a proposition was tentatively discussed for the establishment under our control and direction, of a school for the education and training of gardeners. This proposition has been kept before us during 1916. Although the disturbed international conditions have prevented the proposition from assuming a positive form, yet plans and methods of procedure, in case the plan shall materialize, have received considerable attention.

Similar attention has been given to a proposition for the establishment, under our control and direction, of a school for training teachers for the management of school gardens, the necessary funds to be provided, as in case of the pro-

posed school for gardeners, by those specially interested in the project. We have carried our studies to a point where the work could be at once inaugurated, should the necessity arise.

We have given careful attention to a suggestion coming from persons connected with the public school system of the City, but acting in a private capacity, that we should assign members of the Garden staff to give lectures on botanical subjects in the public schools. We have not deemed it either advisable or authorized for us to engage in this work.

In connection with the two propositions and the suggestion thus reported, we have discussed the general subject of the relations of the Garden to the work of the public instruction of school children. We believe such instruction to be a legitimate and very important part of the Garden's work, provided for in our charter, but that it should be done at the Garden, and in such a way as to be applicable to the public, as such. We do not see that it is practicable, even if it were proper, for us to carry our work into the public schools, without opening the door to serious future complications. As to our lecture work at the Garden, we believe that no study or effort should be spared for increasing its educational efficiency. Much has been done in this direction during the past year, and in our plans for the future.

The course of ten lectures on horticultural subjects provided last spring, was planned along this line. Although we encountered exceptional interference in the form of bad weather, this course was very successful, as to both interest and attendance, an average of 113 auditors being registered.

The ordinary lecture courses of the year have been maintained, the lectures being continued through the summer months. The details of these courses will be presented in the administrative reports.

A special course of members' lectures has been provided for next year, to be given in the small lecture room at the Mansion.

In this connection, the education features, as well as the decorative value of the Iris Garden and the Rose Garden, should be considered. The highly ornamental value of the irises and their location at so public a position as the south entrance, will necessarily attract great attention, and such a variety as 350 forms of a single class of the genus cannot fail to prove instructive, even to the casual visitor. The same is true, even in a greater degree, of the Rose Garden, representing as it will do, many species as well as varieties.

Ample provision has been made for the establishment of a temporary Convention Garden, to be maintained this summer in connection with the annual Convention of the Society of American Florists and Ornamental Horticulturists, the Society to provide the necessary funds. An admirable location has been selected and prepared for the accommodation of a large attendance. The suggestion of possible permanent maintenance of such a display garden is well worthy of consideration.

A proposition to establish an experimental garden for drug culture, in connection with the College of Pharmacy, which is to provide the necessary funds through special subscription in the drug trade, has been considered, and we await the necessary action by that institution.

The year has shown much activity in publication. The most notable event in this connection is the completion of Volume 9 of North American Flora, the first volume to be completed. The last parts of another volume are nearly ready for publication. Complete success has attended the inauguration of our new journal, Addisonia. Not only has the first volume met with a flattering general reception, but the number of subscriptions has already rendered its publication self-supporting.

Another notable publication is Vol. 6 of the Memoirs, which embodies the collection of papers presented at our Twentieth Anniversary Celebration. It is a volume that will take a high and permanent position in botanical literature.

Our new Guide-book, forming a part of the Bulletin, and also published separately, is a great improvement on its predecessor. Its usefulness is increased through the naming of all important locations in the Garden. This edition includes the new land recently acquired, and is enriched by an excellent map.

Although the work of exploration, owing to scarcity of funds, has not shown the activity of some former years, yet some good work has been done in this direction. The months of February and March were spent by Dr. and Mrs. Britton, accompanied by Mr. Wilson, in the Isle of Pines and large and important collections were secured. Through the generosity of Mr. Charles Deering, Dr. Small has been enabled to make two visits to southern Florida, exploring little known regions, and making important discoveries. At the present time, Dr. Shafer is at work in Argentina, his special mission being to secure representations of the cactus flora of that country. In this connection, reference should be made to the explorations of Dr. Rose, in Venezuela, in the interest of the same work. Although this expedition was conducted by the Carnegie Institution, its direct connection with our monograph on the Cactaceae, entitles it to mention in this report.

Great and increasing difficulty has been experienced in finding accommodations for the accessions to the herbarium. Some relief was experienced by the building of twelve additional cases, but this was temporary and insufficient. In spite of it, and of the crowding of the cases to such an extent as to injure and endanger the safety of the specimens, it has been found necessary to bundle up and store numbers of specimens which are thus rendered inaccessible for study. The necessity for additional herbarium space has now become acute and must be met in some way during the coming year. Steady increase in herbarium material is not merely desirable; it is inevitable. When a herbarium has reached such proportions and such importance as ours, it becomes a natural magnet for the

attraction of additional material. It is also to be remembered that the collections of living and dried plants, together with the library, constitute the basic elements in our scientific work, which must be provided for, if our development is to continue.

The library accommodations present the same condition of overcrowding as do those of the herbarium.

Fourteen special students, exclusive of visiting botanists, have been engaged on research problems during the year. The most of this work has been in the direction of cytology and genetics, the subjects having included Primula, variegated forms of Tussilago, Catharanthus, Eschscholtzia, Cichorium, Hibiscus, and Carex. One student has engaged in a study of the black oaks of southern New Jersey, with special reference to hybridity. Two have pursued studies in pathology. One has continued his investigations of the flora of western Tibet. Professors Harper and Gies have carried out their plan, announced in our last report, of studying chemically the pigments in the leaves of Coleus.

The Directors have given some thought to the increasing tendency of research students to pursue their botanical work at the several university laboratories of the City. The incomparable natural advantages at such an institution as ours for the pursuit of every form of botanical research should cause it to be sought by all intending to engage in such work. The probable reasons for the tendency to select other laboratories were made the subject of special discussion at our December meeting. It appears that the several university departments have made a bid for this class of students by greatly improving their laboratory and teaching equipments, and the location of these on the university grounds is found more convenient than that of ours. In spite of these facts, however, we believe that a proper and sufficient effort on our own part should result in making the attractions of the Garden laboratories paramount, and we have delegated a special study of such requirements to Professors Harper and Gies.

In view of the several prospective undertakings herein referred to, and the various opportunities for our activity thus opened, we look forward with peculiar interest to the developments of the coming year.

Respectfully submitted,

H. H. RUSBY,
Chairman.

REPORT OF THE COMMITTEE ON PATRONS, FELLOWS, AND MEMBERS FOR THE YEAR 1916

To the Board of Managers of the New York Botanical Garden.

Gentlemen: The number of new members who have qualified is 126. The number of annual members is now 883; life members 147; sustaining members 12; fellowship members 2.

Of these 18 are now in arrears for dues for 1916, 8 for dues for 1915 and 1916, 5 for dues for 1914, 1915 and 1916.

Dues have been collected to the amount of $9220, which have been transmitted to the treasurer as received.

A complete list of all classes of members to date is herewith submitted.

Benefactors

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Alfred L. Simon,
John W. Simpson,
Charles A. Singer,
Dr. Frank D. Skeel,
Francis Louis Slade,
Benson B. Sloan,
Samuel Sloan,
Thomas Smidt,
Daniel Smiley,
Miss Fanny A. Smith,
Frank Morse Smith,
Pierre J. Smith,
R. A. C. Smith,
E. G. Snow,
Mrs. Charlotte Sorchan,
Mrs. Edward W. Sparrow,
Mrs. Gino C. Speranza,
J. R. Stanton,
James H. Stebbins,
James R. Steers,
Chas. H. Steinway,
Fred. T. Steinway,
Wm. R. Steinway,
Olin J. Stephens,
Roderick Stephens,
Benjamin Stern,
Sereno Stetson,
Alexander H. Stevens,
Mrs. Byam K. Stevens,
Frederic W. Stevens,
Dr. Geo. T. Stevens,
Mrs. John Wood Stewart,
Lispenard Stewart,
Mrs. Percy Hamilton Stewart,
Wm. R. Stewart,
Chauncey Stillman,
Miss Clara F. Stillman,
Dr. D. M. Stimson,
James Stokes,
H. Grant Straus,

Albert Strauss,
Chas. Strauss,
Frederick Strauss,
Martin Strauss,
Samuel Strauss,
Mrs. Gustav Stromberg,
Benj. Strong, Jr.,
John R. Strong,
Mrs. Theron G. Strong,
Joseph Stroock,
F. K. Sturgis,
Mrs. F. K. Sturgis,
Mrs. James Sullivan,
Miss Mary Taber,
Henry W. Taft,
Edward N. Tailer,
E. H. T. Talmage,
C. A. Tatum,
Henry R. Taylor,
W. A. Taylor,
C. H. Tenney,
H. L. Terrell,
Mrs. John T. Terry,
Thomas Thacher,
Miss M. J. Thayer,
Mrs. Hector W. Thomas,
Mrs. Howard L. Thomas,
Seth E. Thomas, Jr.,
L. S. Thompson,
Lewis M. Thompson,
William B. Thompson,
Dr. W. Gilman Thompson,
Jonathan Thorne,
Samuel Thorne, Jr.,
W. V. S. Thorne,
Myles Tierney,
Louis C. Tiffany,
Henry N. Tifft,
H. M. Tilford,
James Timpson,
J. Kennedy Tod,
P. S. Trainor,
A. F. Troescher,
Frederick K. Trowbridge,
Carll Tucker,
Dr. Alfred Tuckerman,
Paul Tuckerman,
Geo. E. Turnure,
Benjamin Tuska,
Mrs. Mary A. Tuttle,
E. S. Twining,
Lucien H. Tyng,
Mrs. Eliza L. D. Tysen,
Oswald W. Uhl,
Theodore N. Vail,
James J. Van Alen,
Barend Van Gerbig,
E. H. Van Ingen,
Edgar B. Van Winkle,
Hon. Robert A. Van Wyck,
Mrs. Wilbur Linwood Varian,
Mrs. James M. Varnum,
Richard C. Veit,
Thos. F. Vietor,
Alfonso P. Villa,
Frank Vincent,
Mrs. Gustavus A. Walker,
James N. Wallace,
Leo Wallerstein,
Wm. I. Walter,
Artemus Ward,
Mrs. John I. Waterbury,
C. W. Watson,
Thomas L. Watt,
Mrs. E. H. Weatherbee,
H. Walter Webb,
J. G. Webb,
Mrs. W. Seward Webb,
Miss Alice D. Weekes,
Chas. Wehrhane,

Charles H. Weigle,
Bernard Weinig,
Mrs. C. Gouveneur Weir,
Mrs. Samuel W. Weiss,
Mrs. John Wells,
Arthur L. Wessell,
Dr. William West,
Mrs. Robert E. Westcott,
William Young Westervelt,
Mrs. Alice T. Wheelock,
Dr. Wm. E. Wheelock,
Miss Caroline White,
Horace White,
Mrs. Stanford White,
Clarence Whitman,
Miss Margaret S. Whitney,
Edward A. Wickes,
Elmore A. Willets,
Mrs. Percy H. Williams,
Richard H. Williams,
William H. Williams,
W. P. Willis,
James R. Williston,
Frank D. Wilsey,
Prof. Edmund B. Wilson,
Miss Margaret B. Wilson,
M. Orme Wilson,
Bronson Winthrop,
Egerton Winthrop,
Grenville L. Winthrop,
Mrs. Robt. Winthrop,
Mrs. Frank S. Witherbee,
Dr. R. A. Witthaus,
Ernst G. W. Woerz,
Emil Wolff,
Lewis S. Wolff,
William E. Wolff,
Mrs. Cynthia A. Wood,
Prof. R. S. Woodward,
Miss Julia Wray,
Mrs. J. Hood Wright,
Mrs. A. Murray Young,
Andrew C. Zabriskie,
Joseph A. Zanetti,
Mrs. Anna M. von Zedlitz,
Charles H. Zehnder,
August Zinsser,
Charles Zoller,
O. F. Zollikoffer.

Members of the Women's Auxiliary

Mrs. Robert Bacon,
Mrs. Thomas H. Barber,
Miss Elizabeth Billings,
Miss Eleanor Blodgett,
Mrs. James L. Breese,
Mrs. Charles D. Dickey,
Mrs. Walter Jennings,
Mrs. Delancey Kane,
Mrs. Hamilton F. Kean,
Mrs. A. A. Low,
Mrs. Charles Mac Veagh,
Mrs. V. Everit Macy,
Mrs. Henry Marquand,
Mrs. George W. Perkins,
Miss Harriette Rogers,
Mrs. James Roosevelt,
Mrs. Archibald D. Russell,
Mrs. Benson B. Sloan,
Mrs. Henry O. Taylor,
Mrs. George Cabot Ward.

Honorary Members of the Women's Auxiliary

Mrs. E. Henry Harriman,
Mrs. John I. Kane,
Miss Olivia E. P. Stokes,
Mrs. F. K. Sturgis,
Mrs. F. F. Thompson.

REPORT OF THE TREASURER

NEW YORK, January 8, 1917

TO THE BOARD OF MANAGERS OF THE NEW YORK BOTANICAL GARDEN.

Gentlemen: Herewith I submit a statement of my receipts and disbursements during the year 1916, and balance sheet from my ledger as of December 31, 1916.

Respectfully yours,
JAMES A. SCRYMSER,
Treasurer.

RECEIPTS AND DISBURSEMENTS

Receipts

Balance as per Annual Report of 1915		$ 17,459.08
Contributions of the City toward Development and Maintenance	$ 89,933.07	
Legacy, Maria DeWitt Jesup, 35% of amount	8,750.00	
Legacy, Emil C. Bondy, to be credited to Endowment Fund for Science and Education	5,000.00	
Rose Garden and Garden Extension Fund, Contributions	8,395.00	
Contributions to the Museum and Herbarium Fund	500.00	
Contributions to the Public Lecture Fund	550.00	
Contributions to Students Research Fund	261.00	
Subscriptions to "Addisonia," credited to Income of Addison Brown Fund	2,220.00	
Contribution to Special Fund for Books	25.00	
Annual Dues	8,620.00	
Fellowship Members' Fees	200.00	
Sustaining Members' Fees	300.00	
Subscriptions to "*North American Flora*," Sales of Publications, etc.,		

credited to Income of David Lydig Fund		2,765.77
Plant Fund		98.50
Refunds, credited to Income of Stokes Fund		20.55
Sales of Ashes		50.00
Loss on Exchange, Collection		.10
Income from Investment of John Innes Kane Fund, Interest 6%, $10,000 New York City Notes		600.00
Income from Investment of Maria De Witt Jesup Fund, $15,000 Northern Pacific Prior Lien Bonds		600.00
Income from Investment of Addison Brown Fund, 4% on $22,000 Northern Pacific P. L. Bonds		880.00
Income from General Investments:		
Credited to General Income Account:		
5% on $50,000 Southern Rwy. 1st Consolidated Mortgage Bonds	$2,500.00	
4½% on $50,000 Ches. & Ohio R. R. Co. General Mortgage Bonds	2,250.00	
4% on $50,000 Erie R. R. Co. Prior Lien Bonds	2,000.00	
4% on $59,000 Erie R. R. Co. Penn.-Coll. Trust Bonds	2,360.00	
4% on $50,000 Reading R. R. Co. Jersey Central Coll. Trust Bonds	2,000.00	
4% on $24,000 Northern Pacific R. R. St. Paul & Duluth Div.	960.00	
4% on $30,000 Northern Pacific R. R. Gt. Nor.-C. B. & Q. Coll. Trust Bonds	1,200.00	
4% on $5,000 Northern Pacific R. R. Gt. Nor.-C.		

B. & Q. Trust Bonds, 80 days	44.44	
4% on $10,000 New York City Stock, due 1959	400.00	
5% on $10,000 Louisville & Nashville R. R. Equipment Notes	500.00	
4½% on $10,000 N. Y. Central Lines Equipment Notes	450.00	
4% on $11,000 Milwaukee, Sparta & N. W. R. R. Bonds	440.00	
4½% on $50,000 Pennsylvania R. R. General Mtge. Bonds	2,250.00	
6% on $50,000 New York City Notes	3,000.00	
5% on $10,000 Balto. and Ohio R. R. Bonds, 7 months	291.67	$ 20,646.11
Interest at 3% on balances with J. P. Morgan & Co., year 1916	407.97	
Total Receipts		$150,823.07
		$168,282.15

Disbursements

Investment of the Endowment Fund for Science and Education, $10,000 Balto. and Ohio 5% Bonds	$ 10,025.00	
Investment of the Endowment Fund for Science and Education, $5,000 Nor. Pac. R. R. Bonds C. B. & Q.	4,918.75	
	14,943.75	
Expenses paid through Director-in-Chief:		
Account of City Appropriations	$ 89,933.07	
General Accounts for Vouchers Paid	27,572.59	
Special Book Fund for Books	6.45	
Plant Fund for Purchase of Plants	98.35	
Garden Extension and Commemoration Fund	1,690.39	

Rose Garden and Garden Extension Fund	7,297.29	
Income of David Lydig Fund for Publications	6,440.23	
Income of D. O. Mills Fund for Sundries	1,785.86	
Income of Stokes Fund for Printing.	301.16	
Income of Science and Education Fund	2,329.51	
Income of Henry Iden Fund	398.75	
Income of William R. Sands Fund	447.00	
Income of John Innes Kane Fund	539.43	
Income of Maria DeWitt Jesup Fund	597.88	
Income of Addison Brown Fund	2,573.75	
Public Lecture Fund	363.03	
Museum and Herbarium Fund	447.00	
	142,821.74	
Total Disbursements	$157,765.49	
Balance, Cash in hands of Treasurer (on deposit with J. P. Morgan & Co.)	10,516.66	
	$168,282.15	$168,282.15

Ledger Balances, December 31, 1916

Credit

Permanent Funds

Endowment Fund	$304,510.00
Endowment Fund for Science and Education	83,455.00
David Lydig Fund, Bequest of Charles P. Daly	34,149.86
Legacy of William R. Sands	10,000.00
Darius Ogden Mills Fund	50,000.00
Henry Iden Legacy	10,000.00
Addison Brown Legacy	21,850.00
John Innes Kane Fund	10,000.00
Stokes Fund	3,000.00
Charles Budd Robinson Memorial Fund	652.30
Students Research Fund	3,882.00
Maria DeWitt Jesup Legacy	22,500.00
	$553,998.16

Temporary Funds		
Garden Extension and Commemoration Fund	$ .57	
Rose Garden and Garden Extension Fund	1,097.71	
Income Maria DeWitt Jesup Fund	113.12	
Income of Students Research Fund	195.46	
Income John Innes Kane Fund	2.70	
Income Addison Brown Fund	2,358.62	
Income Charles Budd Robinson Memorial Fund	38.75	
Life Membership Dues	500.00	
Special Fund for Books	96.12	
Plant Fund	166.07	
Exploration Fund	24.05	
Public Lecture Fund	186.97	
Museum and Herbarium Fund	26.08	
Charles Finney Cox Memorial Fund	6.90	$558,812.28
General Investments	*Debit*	
$50,000 Ches. & Ohio Gen'l Mtge Bonds		
50,000 So. Ry. Co. 1st Cons. Mtge Bonds		
50,000 Erie R. R. Co. Prior Lien Bonds		
59,000 Erie R. R. Co. Penn.-Coll Tr. Bonds		$312,424.18
50,000 Reading R. R. Co. J. C. Coll. Tr. Bonds		
24,000 Nor. Pac. R. R.-St. P. & D. Div. Bonds		
30,000 Nor. Pac. Gt. Nor.-C. B. & Q. Coll. Tr. Bonds		
10,000 N. Y. City, 4% Stock, 1959		
Investment, D. O. Mills Fund,		
$50,000 Penn. R. R. Gen'l Mtge. Bonds, 4½%	50,418.33	
Investment, Science and Education Fund,		
$10,000 N. Y. Central Lines Equipment	$ 9,510.48	

10,000 Louisville & Nashville Equipment.	10,000.00	
50,000 N. Y. City Notes, due Sept. 1, 1917, 6%.	51,281.25	
10,000 Balto. & Ohio Refunding Gen'l Mtge. Bonds, due Dec., 1995, 5%.....	10,025.00	
5,000 Chic. Burlington & Quincy R. R. Jt. 4s., July 21, 1921....	4,918.75	85,735.48
Investment, Henry Iden Fund, $11,000 Milwaukee, Sparta & N. W. R. R. Bonds.....		10,120.00
Investment, Addison Brown Legacy, $22,000 Nor. Pac. Prior Lien Bonds, 4%.....		21,380.69
Investment, John Innes Kane Fund, $10,000 N. Y. City Notes, due Sept. 1, 1917, 6%.....		10,256.25
Investment, Maria DeWitt Jesup Fund, $15,000 Nor. Pac. Prior Lien Bonds, 4%.....		13,378.75
		$503,713.68
Income of David Lydig Fund, balance borrowed from Permanent Fund.....		2,524.80
Income of Stokes Fund.....		27.70
Director-in-Chief, Working Fund.....		25,000.00
Museum and Herbarium Fund.....		26.92
General Income Account, balance borrowed from Permanent Fund.....		17,029.44
Cash in hands of Treasurer, Jan. 1, 1917 (on deposit with J. P. Morgan & Co.).	10,516.66	
	$558,812.28	$558,812.28

REPORT OF THE SPECIAL AUDITOR

Treasurer's Account for the Year 1916

Room 3111, Grand Central Terminal
New York, February 24, 1917

Mr. Edward D. Adams,
Chairman, Finance Committee, New York Botanical Garden,
71 Broadway, New York, N. Y.

Dear Sir:

This is to certify that I have, by direction of the Board of Managers, examined the books and accounts of the Treasurer of the New York Botanical Garden, for the year nineteen hundred and sixteen (1916), together with their proper vouchers, and that I find the balance sheet and the Treasurer's statement of receipts and disbursements attached hereto to be correct.

I have also examined the various investment securities and find the same to be as reported in the said balance sheet.

Respectfully submitted,
A. W. Stone,
Special Auditor.

Director-in-Chief's Account for the Year 1916

Room 3111, Grand Central Terminal
New York, February 24, 1917

Mr. Edward D. Adams,
Chairman, Finance Committee, New York Botanical Garden,
71 Broadway, New York, N. Y.

Dear Sir:

This is to certify that I have examined and audited the financial books and accounts of the Director-in-Chief of the New York Botanical Garden for the year nineteen hundred and sixteen (1916), and that I find the same to be correct, and the cash balance to be as stated in the current cash book.

In accordance with recent practice, I have not included in this auditing the examination of the vouchers for City maintenance or construction work paid for by the City, as such vouchers have been found proper and in order by the City authorities, and it was decided in 1904 by the Chairman of the Finance Committee that a further examination of them was unnecessary. By like authority I have omitted also a detailed examination of the annual membership dues account. These dues are received by the Director-in-Chief and forwarded by him to the Treasurer, the former keeping a detailed record of the same.

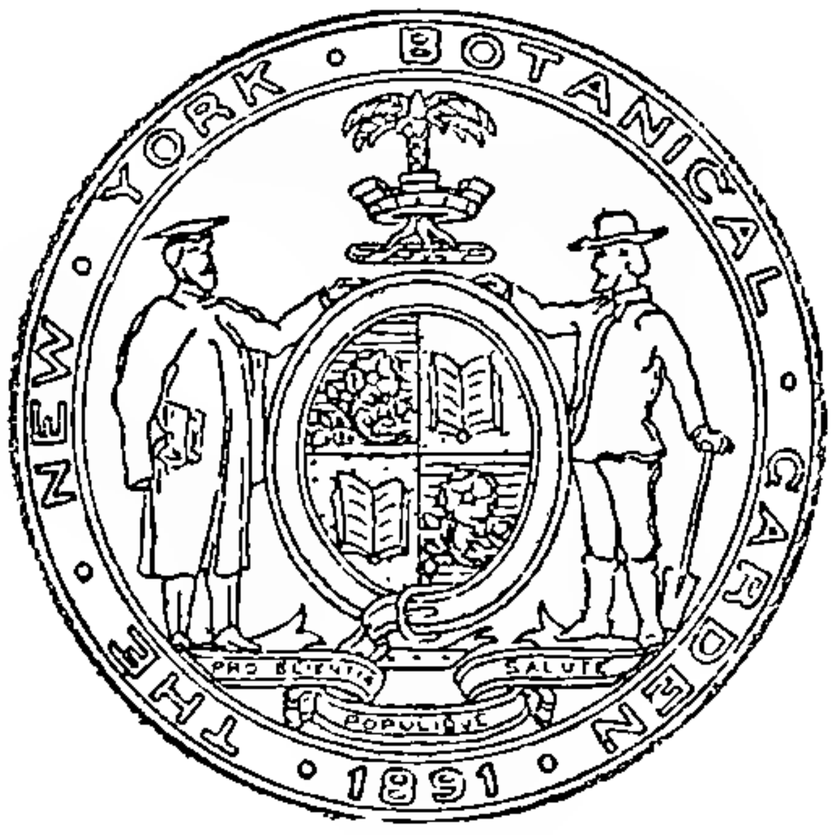
Respectfully submitted,
A. W. Stone,
Special Auditor.

VOL. 9 NO. 36

BULLETIN

OF

THE NEW YORK BOTANICAL GARDEN



[ISSUED APRIL 30, 1918]

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BULLETIN
OF
The New York Botanical Garden

Vol. 9 No. 36

REPORT OF THE SECRETARY AND DIRECTOR-IN-CHIEF FOR THE YEAR 1917

(*Accepted and ordered printed, January 14, 1918*)

To the Board of Managers of the New York Botanical Garden.

Gentlemen: I have the honor to submit my report as Secretary and Director-in-Chief for the year ending January 14, 1918.

Noteworthy progress has been made in the development of the institution and in the improvement of its grounds during the past year. Gifts of money for construction of buildings, and for paths, grading and planting, have aggregated $107,300; gifts, and purchases by the income of permanent special funds, of plants, books and specimens have materially increased the collections and have made them more valuable scientifically and educationally; the new planting accomplished has added much to the interest and beauty of the grounds. Work on development has been accomplished both within the original reservation of 250 acres and within the area of about 140 acres added to the reservation by the city in 1915. The older plantations have all been maintained and the natural beauty of the tract has suffered no deterioration. The path system has been considerably developed by work done upon it in various parts of the grounds in accordance with the general plan, somewhat more than half a mile of paths, averaging 10 feet in width, having been wholly or partially com-

pleted; this included approaches to the rose garden and paths within that garden, and nearly the complete path system of the area south of the herbaceous garden, which was used during the season for the convention garden of the Society of American Florists and Ornamental Horticulturists, now planned for special horticultural plantations.

Collectively, the number of kinds of living plants now represented in the collections is approximately 14,195, being a slight increase over the number represented in the previous year and the largest number of kinds in cultivation in the history of the institution. Additions to the museums and herbarium aggregated over 22,000 specimens, secured mainly by exchange with other institutions and through exploration. The library was increased by about 895 bound volumes, and now contains about 28,500 bound volumes; valuable gifts of books were made by Mr. Nathaniel T. Kidder and by Mrs. George D. Pratt.

Under the direction of the Endowment Committee, plans for the further development of the Garden were prepared, including designs for all edifices required, and these were drawn and rendered in color by Mr. John R. Brinley, our Landscape Engineer, and his assistant, Mr. L. F. Bird. For the construction of two of the greenhouses needed at conservatory range 2, Mr. Daniel Guggenheim and Mr. Murry Guggenheim each contributed $50,000; Mrs. Robert E. Westcott gave $2,000 for building a stone stairway leading down into the rose garden; Mrs. Frederick F. Thompson contributed $4,000 for the construction of the school garden shelter; Mr. Edward D. Adams presented three steel flag poles, costing $918.70; and Dr. and Mrs. N. L. Britton have given the cherry garden shelter for construction during 1918, an estimated cost of about $4,000, the plans for this shelter being contributed by Mr. Brinley without charge. The report of the Endowment Committee describes these gifts in detail and refers also to additional funds needed for endowment.

Public instruction was continued through lectures de-

livered on Saturday afternoons in the museum building from April 28 to October 20; instruction by docents has been somewhat expanded, this being made available for parties of both children and adults every week-day afternoon. Nature-study lectures were delivered to high school students. The laboratories and experimental grounds and greenhouses have been used by advanced students from colleges and universities. Increased use of the library has been made by visiting students and investigators. The amount of information given out by mail is increasing, requiring much of the time of members of the staff. Botanical exploration under the auspices of the Garden was accomplished in Argentina, in Colombia, in South Carolina, and in Florida. In cooperation with the Horticultural Society of New York, public exhibitions of plants and flowers were given monthly during the summer, and over 5,000 rose bushes were planted in the new rose garden.

In cooperation with the International Children's School Farm League, instruction in gardening was organized in April and has since been continued; land for the purpose was prepared on the eastern side of the grounds south of the nurseries, rooms for teaching purposes were fitted up in the mansion, and greenhouse instruction has been given in one of the propagating houses. All courses are available for students during 1918.

Publications during 1917 include Volume 18 of the *Journal*, Nos. 31 and 35 of the *Bulletin*, Volume 9 of *Mycologia*, 3 parts of *North American Flora*, 11 numbers of *Contributions*, and the second volume of *Addisonia*.

Permanent funds were increased by the final 10 per cent. of the bequest of $25,000 by Maria De Witt Jesup, being $2,500; by $1,000 Fellowship fee of Mrs. John A. Roebling; and by fees of students aggregating $121, added to the principal of the Students Research Fund. The total endowment now amounts to approximately $557,000.

Many gifts of living plants were received, including

Japanese cherry trees from Mr. T. A. Havemeyer, catalpa trees from Mrs. Florence Lydig Sturgis, palms from Mr. Ogden Mills, and conifers from Mr. Henry Hicks.

Plants and Planting

The various plantations already established have been more or less modified by the addition of some plants and the elimination of others, for one reason or another; for details of gardening operations, reference is made to the report of the Head Gardener herewith submitted.

1. *Herbaceous Gardens*

The long valley occupied by the plantations of named and labeled herbaceous plants, and containing the oldest plantations established by us, has been but slightly modified during the year. This valley furnishes the longest vista line within the reservation, a practically uninterrupted view of about 1,800 feet being had from either end; this view is perhaps best from the southern end of the valley, at a point on one of the new paths leading to the south. So many other plantations have been established in recent years that it is now desirable to strengthen the supervision of this collection by putting it in charge of a qualified botanical gardener. It is believed that both its educational and artistic value would be increased by such supervision. The water supply of the northern portion of this tract is at present unsatisfactory and a modification of it is desirable. The construction of the shelter-house planned by the Endowment Committee for a point near the economic plantations would add greatly to the interest of the valley.

2. *Fruticetum*

The named and labeled collection of shrubs occupying the terrace plain northeast of the lakes has been increased by the addition of a number of species, and now contains just about 1,000 species and varieties. It was found during the season that the thorn-planted circle at the crossing of

the main driveways here had grown so dense as to obstruct the view, so much so as to make driving dangerous at this point; the view was restored by thinning the plantation materially. The shelter-house planned for this plantation will be a very beautiful structure, to be located near the forest border to the east.

3. *Salicetum*

The collection of willows in the north meadows has been modified only by the elimination of certain specimens, which were removed in order to improve the form of contiguous trees.

4. *Deciduous Arboretum*

As suggested as desirable in my last annual report, considerable work was accomplished at various points in the arboretum area which occupies the whole eastern side of the reservation, the specimen trees being planted over an area of about three-quarters of a mile in length. Most of the new planting was done at the extreme southern end of this arboretum tract, where mainly additional poplars, willows, and walnuts were set, but additional species and varieties were brought into the collection at various points. The survey of the hardy woody plants in the Garden carried out by the Head Gardener took the form of an enumeration of the species and varieties, which is being printed in successive issues of the Garden *Journal* and the parts reprinted, so that we shall soon have a little book which will contain this information, the catalogue giving the botanical and common name of the plant, its location within the Garden, and its distribution in nature. This survey was extended from the trees to include the shrubs and woody vines. In order to commence to make the arboretum collections more readily accessible to visitors, a considerable extension of the path system was commenced and largely graded, the top-soil obtained from excavations for the new paths being used in building the rose garden.

5. *Pinetum*

The collection of named and labeled conifers occupying the southwestern portion of the reservation surrounding conservatory range 1 has not been materially modified except by the replacement of certain plants which had been killed by unfavorable weather conditions; this included the bringing in of a few additional varieties. Space has been reserved in this area for such additional species and varieties of conifers as may prove to be hardy here.

6. *Viticetum*

The collection of vines and climbers brought together on the wooden arbor on the woodland border east of the economic garden has been maintained but not increased. It was found necessary to cut out a few trees contiguous to this arbor, and a few more should be removed.

7. *Water Gardens*

The collection of aquatics and other water-loving plants established in the two smaller lakes east of the museum building has been maintained without material modification, but it is susceptible of somewhat further development. The hardy water lilies here are a feature of great interest throughout the flowering season, as are also the native bog plants in the smaller of the two ponds.

The collections of hardy and of tender water lilies in the concrete tanks of conservatory range 1 were very successfully maintained and slightly increased. Difficulty was experienced in the tank given over to the tender species by the development of a leak or leaks, which we attempted to find and mend by a complete excavation of all the earth in the planting pockets, but the defect was not wholly remedied and another attempt to find the leaks will have to be made.

8. *Iris Garden*

The iris plantations established during 1916 at the extreme southwestern corner of the reservation developed

successfully, and have made a good commencement of the improvement of that portion of the grounds. Many of the clumps have so much increased in size as to permit dividing them up and extending the collection for a considerable distance to the north, along the new path paralleling the Southern Boulevard, and by other enlargement as suggested in my last annual report.

9. *White Pine Plantation*

Record was made in my last annual report of the planting with young white pines of a rocky hill north of the iris garden, through the interest of Dr. Walter B. James and of Hon. George D. Pratt, State Conservation Commissioner, the area concerned being about one and three-quarter acres. This young forest planting may now be reported as established, some of the trees having reached a height of 2 feet, with relatively small loss. It is proposed in the spring to extend this plantation somewhat laterally by means of a supply of little white pine trees held in our nurseries and the purchase of several hundred more. The plantation has attracted a great deal of attention and brought out much favorable comment. The rocky ridge parallel to the white pine hill to the west, referred to in my last annual report as available for a forest of another kind of tree, may, we think, be well occupied by a similar forest of red pine, and Dr. James has expressed to me his further interest in establishing such a plantation.

10. *Convention Garden*

In cooperation with the Society of American Florists and Ornamental Horticulturists, areas bordering the paths in the region south of the herbaceous garden were planted by several florists and nurserymen with various collections in the spring, although the amount of space occupied by them was much less than they at first contemplated, owing to disturbed business conditions. We have made a complete record of the exhibits in the Garden *Journal* for

October, 1917.* All together, 16 different firms and individuals were represented, whereas it was supposed at the time we consented to this use of the land that there would not be fewer than 50 exhibitors. Some of the plants were given to the Garden by exhibitors, as recorded in the *Journal.* These plantations were pleasing and attracted much interest, and were given an educational value by complete labeling.

It is proposed to occupy the land prepared for this convention garden by special horticultural plantations, to be given backgrounds by groups of conifers, and to include gardens of gladioli, cannas, phloxes, hardy chrysanthemums, marsh mallows, dwarf evergreens, hardy variegated shrubs and trees, and other collections from time to time, the area available being sufficient for a great deal of planting. Some path building is still required here to connect this area with paths already constructed to the north. The plants required for these installations are either already in our nurseries or have been promised by friends, or may be purchased by the income of the John Innes Kane Fund, which is specified for the purchase of plants.

11. *Lilac and Peony Gardens*

The area to be devoted to the special collections of lilacs and peonies just north of Pelham Parkway and east of the mansion approach driveway has not been much modified during the season, but the lilac collection was increased by 96 plants brought from a point in the arboretum near the ash collection, where they had been planted some years ago. These lilacs are largely hybrids, produced at the Buffalo Botanic Garden, by the late Mr. John F. Cowell, and include some very beautiful and remarkable kinds. Mr. T. A. Havemeyer has promised large additions to this lilac collection, and will also contribute largely to the peony collection at such time as we are ready to install it, but much path building and grading is required in this area

* See Jour. N. Y. Bot. Gard. 18: 215, 216.

before anything like a complete installation will be practicable.

12. *Rose Garden*

Beautifully situated in a valley south of the mansion, the collections of bush roses planted here in the spring have been of great interest and beauty and of educational value. Nearly 5,000 plants have been installed there, contributed by the Horticultural Society of New York, grouped in 94 plots over a total area of nearly half an acre, including 422 named kinds, which have all been completely labeled. No progress was made during the year in obtaining either the central pergola or the enclosing iron fence planned for the rose garden, and no provision for climbing roses here has thus been made; some planting of rambling roses on rocks adjacent to the plantation may be accomplished in the spring.

As regards the central pergola and fence, which were much discussed at the time the rose garden was originally determined upon, a suggestion was reported to the Board of Managers at the meeting of November 15, that the plans be modified by substituting a fountain for the central arbor, planned in order to avoid obstruction of the view of the garden which the proposed central feature would necessitate, and a further suggestion that the enclosing fence planned be abandoned, and a return made to the proposition of protecting the collection by guarding only, which has been carried out this year, without appreciable loss, only 4 plants out of over 4,000 having been stolen. These suggestions were referred to the Endowment Committee for further consideration and report, but the Endowment Committee has not as yet taken the subject up. As to the guarding of the plantation, this was accomplished during the season by having one of the keepers report there at daylight and remain until the gardener in charge came in the morning, and then to report again when the gardener left at five o'clock in the afternoon and remain until nine or ten o'clock in the evening. As a matter of fact, I think

that even with an enclosing fence, it would be necessary to guard the area.

The entire path system within the rose garden proper and portions of the surrounding paths and approaches have been completed. Convenient access to the plantation has been supplied through the valued gift by Mrs. Robert E. Westcott of the stone stairway, which was completed in the spring. Some grading remains to be accomplished close by this new stairway, and it is proposed to do this first thing in the coming spring.

13. *School Garden*

For the purposes of the garden school established early in the season, in cooperation with the International Children's School Farm League, about an acre of ground south of the present nursery and east of the long lake was regulated and graded; paths were constructed through it and a water supply brought to it. A small portion of this area was highly cultivated in plots by students during the spring and summer, and as much more land as may be needed may be readily made available. A low concrete tank to contain manure was built at one corner of this garden, and a border plantation of economic plants was established and labeled. Much additional interest has been given to this garden by the shelter-house given for it by Mrs. Frederick F. Thompson, which was nearly built during the autumn and may be completed during the spring. It is of the architectural type called gazebo.

14. *Mansion Garden*

Owing to the pressure of work on other plantations, construction of the formal garden planned for the lawn adjoining the mansion to the south was deferred. Plans of it, prepared by Mr. Brinley, were approved by the Board of Managers, and only a favorable opportunity is awaited for the commencement of its instalment.

15. *Flower Gardens*

The miscellaneous flower gardens already established at conservatory range 1, along the paths leading to this range from the elevated railway station and in front of the border screens along the New York Central and Harlem River Railroad, have all been maintained with minor modifications, and the plants labeled for educational purposes. It is proposed to modify these plantations by substituting for the border screen garden between the Bedford Park Boulevard entrance and the Mosholu Parkway entrance a large collection of dahlias, some of which have been grown in the nurseries and others have been offered by dahlia experts. It is also proposed to modify the plantations at conservatory range 1 by growing the various plants in somewhat larger groups than they are at present, not by reducing the number of kinds exhibited, but by bringing plants of the same kind together. Some of this work may be accomplished in the spring.

16. *Nurseries and Experimental Grounds*

The area occupied by these plantations near the propagating houses has not been materially modified. Experimental work in plant breeding has been carried on here by the Director of the Laboratories, assisted by six advanced students in plant genetics, and practically all prepared land was utilized. Dr. O. S. Morgan, Professor of Agriculture in Columbia University, continued his experimental work on Indian corn on an area of about one-quarter of an acre. Many plants were moved from the nurseries to the various labeled collections during the spring and autumn. The nursery work would be facilitated by the construction of about 1,000 feet of narrow stone road.

17. *Conservatory Range 1*

The grouping of the collections in the great public greenhouse has not been changed; additions have been made nearly throughout the series, and some duplicates have been

eliminated by exchanging them for plants from other institutions. The main grouping remains as described in the third edition of the descriptive guide to the grounds, buildings and collections.*

Some of the palms in the large central house are growing so tall as to endanger the roof and at least one of them will soon have to be removed. In order to grow certain palms to their full height, it would be necessary to have a greenhouse at least 20 feet higher.

18. *Conservatory Range 2*

The grouping of the collections in this greenhouse has remained essentially unchanged, modifications being brought about only by additions and elimination of duplicates. The forced temporary moving of the collections from this greenhouse to conservatory range 1, owing to fuel conditions, described elsewhere in this report, may be taken advantage of next spring and summer to effect what appears to be a desirable regrouping of the greenhouse collections, taken in connection with the two additional greenhouses given for range 2 by Messrs. Daniel and Murry Guggenheim, now under construction. These two additional greenhouses will permit a much better display of all the collections under glass by relieving the present crowding of the plants.

19. *Propagating and Experimental Greenhouses*

Work in plant breeding has been continued, in charge of the Director of the Laboratories and students, and instruction in greenhouse gardening has been given by the Supervisor of Gardening Instruction. Reference is made to the reports of these two officials hereto appended. Considerable propagating work has been accomplished, many plants having been grown from seeds received from warm regions and others by cuttings. One of the houses of this range has been occupied by a part of the great collection

* See Bull. N. Y. Bot. Gard. No. 34, September, 1916.

of cactuses, and this collection has been materially increased, being now the richest in species of any hitherto formed.

20. *Natural Features*

The natural woodlands have been patrolled against fire and vandalism and have suffered no deterioration. Wind storms uprooted some trees and all but a very few dead trees have been removed, this forestry work being in progress at the present time. The wood from fallen and dead trees has all been utilized for fuel in furnaces at the propagating houses and at the mansion.

It is still desirable to extend the low railings along the trails in the hemlock grove in order to further restrict traveling; wherever these rails have been placed, the forest undergrowth has recovered practically all the beauty and interest which were partially lost some years ago by indiscriminate trampling. It has not been possible to extend the system of railings during the past year.

The income of the Caroline and Olivia E. Phelps-Stokes Fund, specified for the preservation of native plants, was used during 1917 for increasing the collection of lantern slides desirable for lectures upon this subject.

21. *Border Screens*

Tree screens planted along parts of the borders prior to 1900 have been pruned and somewhat thinned. The screen established along the northeastern boundary, now the junction with the Bronx River Parkway Reservation, has become unnecessary and undesirable, as better landscape effects can be had by its partial elimination, and it is proposed to cut out many of the trees, leaving only some good specimen plants.

Museums

The collections in the public museums have been conserved and somewhat increased, and modified by substitution of specimens. Additional labeling has been accomplished. Some specimens held in storage have been

incorporated into the several series of exhibits, and a considerable number remain for further incorporation.

1. *Economic Museum*

The very extensive and valuable collection of crude and refined products of plants, illustrating the fundamental relationship of the vegetable kingdom to the arts, sciences and industries, has taken on additional importance under present conditions of world-wide consideration of new uses for plant substances. This museum of plant economics occupies 218 cases, each 7 feet high by 5 feet wide, on the main floor of the museum building. We are continually answering inquiries relative to one product or another, and the carefully identified and labeled collection impresses all who view it with the dependence of the human race upon the plant world.

The collection has been brought together from a great variety of sources. Our numerous exploring expeditions in little-known regions obtained many specimens of exceptional value; many have been obtained by exchanges with other institutions, and many have been contributed by commercial firms. The material is classified in the museum primarily under the various categories of products, such as foods, drugs, fibers, oils, sugars, starches, etc., with suitable subdivisions. Hitherto we have depended on this classification and the knowledge of our curators to enable us to promptly find any individual specimen required, but the collection has now become so large as to make a complete catalogue of it almost a necessity.

Dr. Rusby, who has acted throughout the accumulation of the material as its Honorary Curator, and to whose interest in it this vastly important collection is mainly due, has recently advised the preparation of such a catalogue and has expressed his willingness to superintend the work, and to commence it immediately; his annual report, herewith submitted, contains further information and suggestion upon this proposition. I recommend that you au-

thorize us to proceed with the preparation of such catalogue and to utilize such employees of the Garden as may be necessary for its production, and further to publish it as a Garden *Bulletin*. We do not now require any special appropriation of money, as the budget provisions will apparently be sufficient.

2. *Systematic Museum*

The grouping of the collections on the second floor of the museum building has not been modified since the issue of the last descriptive guide to the collections,* but the series of exhibits has been made somewhat more complete by the interpolation of new specimens. The collection can be made much more representative, but mainly only through further exploration of regions little known botanically and by additional models and other illustrations. The series of microscopes set up for the public, illustrating various minute plants, continues to attract much interest. These microscopes, it will be remembered, were given some years ago by the late Mr. William E. Dodge.

3. *Paleobotanical Museum*

The collection of fossil plants on the basement floor of the museum building has been conserved but not materially increased. Record is made in the report of Dr. Hollick, the Honorary Curator of this collection, of a valuable addition of specimens from Porto Rico; these illustrate for the first time remains of plants of the tertiary epoch from the West Indies, and are therefore of much scientific significance.

This paleobotanical museum, made up in part of collections deposited by Columbia University, which were accumulated during many years of investigation by the late Professor John S. Newberry, and in part of specimens accumulated by officers of the Garden, is the largest and most important series of fossil plants in the United States, excepting that of the United States Geological Survey at

* See Bull. N. Y. Bot. Gard. No. 34, September, 1916.

Washington. A further display of specimens could be made by constructing additional wall cases.

4. *Herbarium*

The vast collection of herbarium specimens on the upper floor of the museum building has been conserved and considerably increased. It has become one of the most important collections in the world and is the most valuable scientific possession of the institution, being a mine of information about all kinds of plants. It is stored in 233 cases, and enough valuable specimens to fill at least 20 more cases are held in storage; we hoped to obtain additional cases for the herbarium during the past year but we did not succeed in this, and they are still urgently needed in order to bring the valuable material in storage to convenient access of students and investigators. The long series of fruits and seeds and other bulky specimens not susceptible of incorporation in the herbarium proper, is stored in drawers.

Details of work upon the museum and herbarium collections are given in the report of the Head Curator hereto appended.

5. *The Collection of Lantern Slides and Photographic Negatives*

Accumulation of lantern slides for lecture purposes has gone on continuously during the entire history of the institution, and photographic negatives made for the production of lantern slides and other purposes have also accumulated, both as glass negatives and as films. This collection of illustrative material has now become very valuable and important.

The colored lantern slides include primarily those made by Mr. and Mrs. Van Brunt, which have been designated as the Van Brunt Collection; to these other colored slides have been added from time to time, the total number being now 2,809. The uncolored lantern slides number 7,015,

there being thus, collectively, nearly 10,000 lantern slides in the collection.

The photographic negatives and films number 6,717, and are constantly in demand for prints desired by other institutions and by students.

These lantern slides and negatives have been under the general charge of Mr. Percy Wilson, an Associate Curator, assisted by one of the museum aids, but his other duties have been so great as to make it necessary to effect other arrangements for the proper care of the collection. The appointment during the past autumn of Miss Elsie M. Kittredge as an Assistant Curator has now made the critical care of this valuable material possible, and progress is being made in perfecting catalogues, rebinding slides, and classifying negatives.

Library

Increased attention all over the world in recent years to all phases of botany, horticulture and agriculture has greatly increased the literature of plants, the annual output of books and pamphlets having probably doubled during the past decade, and the number of persons qualified to write on these subjects has also at least doubled. Our library has now become one of the most important of all collections of this literature and it is being more and more consulted by students and investigators from all parts of the country. It is classified by subject and is very completely card catalogued. The increase of the library in recent years has now practically occupied all available cases, and it will be unfortunate if we are unable to shelve accessions. The greater part of the increase of 895 volumes during the year has been by gift and by exchanges of our publications for those of other institutions all over the world, relatively little money having been available for the purchase of books. A special fund which would yield about $2,000 a year would be a very important aid in ensuring the completion of the library up to date and in securing certain of the older literature which we have not yet been able to obtain.

Reference is made to the reports of the Bibliographer and of the Librarian hereto appended.

Public Instruction and Information

In addition to the important educational features of the grouped and labeled collections of plants and specimens, and of our various publications, a great amount of information is given out by members of our staff in replying to the questions of visitors and by mail; the answering of letters takes up a considerable amount of time, but the information thus given out is highly appreciated. Direct pedagogic work has also been accomplished through lectures, docentry, laboratory instruction, and through the garden school. Docents are provided every week day for public instruction without charge. Details of educational and scientific work, and of investigations carried on by members of the staff, students, and visiting investigators, will be found in the report of the Assistant Director, that of the Director of the Laboratories, and that of the Supervisor of Gardening Instruction hereto appended.

Cooperation with Garden Clubs

Interesting and mutually stimulating relationships were established during the year with many garden clubs. Under the auspices of The Garden Club of America, members of fourteen clubs held a field day with us on May 10,* about 50 members participating. Lectures have been delivered to many clubs in their home localities by members of the staff, Mrs. Britton having addressed seventeen different organizations and Mr. Parsons five; Dr. Howe, Dr. Seaver and I each lectured to one.

Exploration

The important work of obtaining new botanical and horticultural information and the collection of plants and specimens in regions botanically little known, which has

* See Jour. N. Y. Bot. Gard. **18**: 144, 145. *pl. 200.*

been a feature of the work of the Garden since its establishment, has been continued, but not as extensively as in former years. The most important exploration work accomplished was carried out by Dr. J. A. Shafer, a special agent, who was financed by me personally in making a large collection of living and prepared specimens of cactuses in Argentina, eastern Bolivia, Paraguay and western Uruguay, during the early part of the year. This valuable collection was brought home by him in excellent condition, and has added greatly to the completeness of the monograph of Cactaceae prepared by me in cooperation with Dr. J. N. Rose, of the Smithsonian Institution, for publication by the Carnegie Institution of Washington.

Dr. Henry H. Rusby conducted botanical exploration in the Republic of Colombia during the summer, aided by Dr. Francis W. Pennell, one of our Associate Curators. The expedition was privately financed, and was primarily a search for new or rare drug plants. Dr. Rusby returned in the autumn, bringing with him a large and valuable collection of museum and herbarium specimens, leaving Dr. Pennell in Colombia to continue the work until spring. Dr. Pennell writes that he has made a shipment of specimens from Bogota, and other shipments are expected to follow.

Our valued correspondents, Mr. William Harris in Jamaica, and Brother Leon in Cuba, continued to send valuable collections, especially for the herbarium.

Dr. John K. Small, Head Curator, continued his exploration of extreme southern Florida in cooperation with Mr. Charles Deering, and made two trips into that region, which resulted in supplementing previously large collections obtained through this cooperation by important series of specimens and of living plants. Ordinary funds have not been available during the year for exploration work.

Reference is here made to the great desirability of obtaining additional plants, specimens and information from northern South America, both from scientific and economic

considerations. In consultation with officers of the Gray Herbarium of Harvard University and of the Smithsonian Institution, a plan for extensive exploration of that region has been much discussed, and it has been considered by our Scientific Directors. It has been proposed that a member of the staff of each of these institutions and of the Garden should be detailed for the special work of such an investigation, together with such additional aid as might be obtained for field and museum work, looking toward the preparation of an annotated list of the plants of Colombia, Venezuela, and the Guianas, with contiguous islands, such list to indicate the economic application of their products. There can be no doubt that such an investigation would be very well worth while, and, carried out in the cooperative method proposed, it might be expected to be completed within a reasonable period of time. The museum and herbarium specimens obtained would greatly enrich the collections of the cooperating institutions. From our own standpoint, the valuable living plants which would be obtained would compensate us for the time and money expended. I therefore recommend that you authorize me, in consultation with the Scientific Directors, to enter upon such an investigation, in case the necessary funds can be obtained. I think that $1,000 from the income of the Science and Education Fund may be used for this purpose, which would form a nucleus for other contributions.

This matter brings up again the desirability of a permanent fund specialized for botanical exploration. There is no doubt that a fund yielding about $10,000 a year would be of enormous value in increasing the knowledge of plants and their products.

Roads, Paths, and Grading

The Park Commissioner of the Borough of The Bronx has carried out the provisions of the Garden Charter in relation to the maintenance of driveways, nearly the entire

system of about 4 miles having been again resurfaced and the roads kept in excellent condition. Work was continued on the still uncompleted driveway at the north end of the long lake, where a very large embankment was required, which has now been nearly completed by being used as a dump for contractors having surplus excavation; reference has been made to this uncompleted driveway in two previous annual reports; it still remains to actually complete the embankment, to pave about 700 lineal feet of 30-foot road, and to surface the whole uncompleted stretch of about one-third of a mile. As will be remembered, this driveway is planned to take the place, in part, of the narrow and dangerous road which runs immediatley past the mansion and on which several accidents have already occurred, none of them, fortunately, very serious.

The path system has been extended as elsewhere described.* The path running north from the iris garden to the herbaceous garden was completed, and furnishes, with paths constructed formerly to the north, an uninterrupted walk from Pelham Avenue to the Bronx River Parkway, longitudinally through the Garden reservation. It is hoped that another longitudinal line of path may be completed during 1918. As our plans now stand, the total path system would be completed by the building of about 4 miles more.

Considerable grading has been accomplished at various points, especially during the construction of paths, in building banks around the rose garden, and in preparing the school garden.

All the masonry and concrete bridges in the path and driveway system were carefully examined during the season and repointed wherever necessary, but no considerable amount of work was required on any of them.

The water supply system remains unchanged, except for an extension on the east side of the grounds of a 4-inch main and lateral connection to reach the school garden,

* See Report of the Superintendent of Building and Grounds hereto appended.

and a transferral of the mansion water supply from the 36-inch to the 48-inch city main.

In the autumn, some grading was done at the driveway and path connection with the Bronx River Parkway on the northeastern boundary of our reservation, earth required for filling here being hauled from excavations for the new greenhouses at conservatory range 2; the Bronx River Parkway Commission made the necessary driveway connection, requiring a slight change in the roadway within the Garden at that point, without expense to us. Path building and grading work was aided by the Emergency Fund subscribed by members.

Buildings

The report of the Superintendent of Buildings and Grounds hereto appended records details of work upon buildings. Many repairs have again been necessary and the conditions of obtaining material and the high cost of services of mechanics have made such work expensive. Provision must again be made for extensive repairs during 1918, most of which we hope to accomplish by mechanics in our regular employ, but some of it may have to be referred to contractors.

The most extensive and expensive replacements needed are the benches in conservatory range 1, the bad condition of which was referred to in my last annual report. During the year, we were enabled, by using a part of the Emergency Fund subscribed by members, to replace about 525 running feet of the old benches by new ones built of concrete, which will be permanent and are in all respects satisfactory. It is estimated that at least 1,000 running feet more of these benches should be replaced during 1918, because, in addition to those in conservatory range 1, some in the propagating houses have broken down and require rebuilding.

Another important piece of repair work which we were not able to reach in 1917, but which has become a necessity for 1918, is the painting of the iron boundary fence along

the property line of Fordham University, and along the Bronx Boulevard on the eastern side of the reservation. Reference is made in the following chapter as regards fuel to the necessity for enlarging coal bins at both power houses. We sought to enlarge the bin at power house 1 during 1917, but were not able to accomplish this; plans were prepared and approved.

Fuel

The mounting cost of fuel forced the expenditure for coal during the first six months of the year of practically the entire estimated amount needed for the whole year; to meet the additional requirement, the city Board of Estimate and Apportionment added the sum of $5,095.50 to the appropriation for maintenance, and this was wholly expended. In December, after the general coal shortage of the country began to be acutely realized, the contractors concerned found themselves unable to complete all deliveries called for during 1917, and the valuable plant collections in conservatory range 2 became seriously endangered, the conditions being aggravated by abnormally low temperatures.

The city had anticipated difficulty in obtaining coal, by ordering a supply for January, February, and March, 1918, delivered to departments and institutions before the end of December, 1917, but each of the two contractors concerned with us were unable to supply the whole amounts called for in several grades. The No. 3 buckwheat coal, delivered for burning by forced draft at power house 1, proved to be of such poor quality that we have had to buy much bituminous coal to mix with it, in order to keep steam pressure up to requirements; this bituminous coal has been obtainable only in small quantities during December and January, and we have also had to use some of it in power house 2, on account of inability to obtain the pea coal required for the furnaces there.

On January 3, 1918, after correspondence and conversa-

tion with the contractors and officials of the Park Department, and a presentation of the conditions to President Thompson, I very reluctantly ordered the collections in conservatory range 2 transported to conservatory range 1, a step which I had been considering for some days. It seemed to us wisest to save the collection in this way, because a snowstorm at this time might have blocked the roads and would certainly have caused the loss of the whole collection, as we had less than three days' supply of coal in the bunkers. Although moved during very low temperatures (lower than 12° F. most of the time), the plants were transported without serious loss, except the large and elegant vines which festooned the walls; of these plenty of cuttings were taken, so we do not expect to lose any species, and all their roots have been deeply mulched with fresh manure in the hope that they may remain alive. The plants were loaded on spring wagons in the cellar of range 2, packed in straw, covered by blankets, and rushed to the cellar of range 1, a distance of just about a mile. The roads were extremely icy and horses' shoes had to be kept sharpened continuously, but we had enough animals to make this possible. The Garden is indebted to Mr. Nash, Head Gardener, to Mr. Corbett, Superintendent of Buildings and Grounds, to Mr. Finley, Foreman Gardener, to Mr. Willey, Head Driver, to Mr. Radlein, Gardener in charge of range 2, and to the gardeners, drivers, and laborers concerned, who all worked to the limit of endurance. Fortunately, a small additional amount of fuel was delivered by contractors during the period of moving.

Perhaps no such emergency will occur again, but it emphasizes the necessity for greater coal storage capacity than we now have. Reference has been made elsewhere in this report to our failure to obtain during 1917 the enlargement of the coal bin planned at power house 1; I now regard it as desirable to enlarge the bins at both power houses during 1918. If it could be made possible to purchase and store at least half the coal necessary for winter during the summer, safety would probably be secured.

During the period while these greenhouses are empty, advantage will be taken of the opportunity to paint the interiors wherever needed and to make other necessary repairs.

Administrative

There have been no changes in officers nor in the membership of the Board of Managers during the year, nor any changes in the membership of the staff. Duties of members of the staff have been modified only in minor details; the greater part of their time has been fully occupied by maintenance duties, the care and classification of the collections, and by pedagogic work and the giving out of information to visitors, by mail, and by publication. A small amount of time of some of the staff members has been found for scientific investigation. The establishment of several research positions, independent of maintenance or curatorial duties, would undoubtedly contribute largely to botanical and horticultural knowledge.

Public Uses of the Grounds and Buildings

Following the provisions of the Garden's Charter, the whole reservation of nearly 400 acres of land in the northern part of Bronx Park and all the buildings are open to the public every day in the year without any charge whatever. The attractive natural features and the numerous beautiful gardens and other plantations, educationally grouped and labeled, bring a continually increasing number of visitors. Spaces for the use of picnic parties in various parts of the grounds have been set apart by the Board of Managers and these locations approved by the Board of Estimate and Apportionment. The only restrictions applied under the rules and regulations of the Garden are against depredation or damage to the collections, or littering the ground with rubbish, the latter not easy to control. During the winter, skating is permitted on two of the larger ponds. No concessions of any kind have been granted. Guide-books, picture postal cards and photographs showing Garden

views have been sold at the elevated railway entrance, at the museum building and at the mansion, and the proceeds used for printing such documents. A few surplus greenhouse plants have been sold and the proceeds credited to the Plant Fund, which is used to purchase plants; proceeds of the sale of surplus hay harvested have also been credited to the Plant Fund. The only money charges made are for the actual instruction of special students by one member of the staff or another, and in cases where deserving students find payment impossible, scholarships are granted. Painting, sketching and photography are permitted throughout the entire reservation, and this privilege has been widely taken advantage of by many artists.

Thus the continued policy of the management is to present every feature of the Garden to the public absolutely without charge and to encourage in every way extensive enjoyment of its varied uses.

Financial

The city appropriation for 1918 is $10,075 larger than that for 1917, and this increase was granted for the purpose of continuing increases in the remuneration of subordinate employees made during 1917 by means of private funds, and to meet the still further advance in prices for material and supplies; it will, apparently, be not more than sufficient to cover these two items. As in recent years, practically all our income from general endowment and from membership dues will be required to supplement the city maintenance appropriation, leaving us only the income of specified funds for educational and scientific purposes. While a considerable number of members have withdrawn during the year, a slightly greater number have joined, so there has been no loss in membership. Owing to disturbed conditions due to the world-wide war, it is impossible to accurately estimate requirements for 1918.

Liberty Bonds

At my request and subsequently confirmed by the Board of Managers, the Treasurer purchased $5,000 worth of each of the first and second issues of Liberty Bonds, and employees were given the privilege of paying for these by instalments if desired. The total subscription has thus far amounted to about $9,200, but certain subscribers have indicated their desire to pay for additional bonds. The list of subscribers to one or the other issues, or to both, is as follows:

John H. Barnhart, Bibliographer
H. W. Becker, Foreman Gardener
Kenneth R. Boynton, Head Gardener's Assistant
N. L. Britton, Director-in-Chief
Thomas M. Cooney, Keeper
L. Dingler, Gardener
E. W. Doherty, Gardener
N. Dudeshyn, Gardener
James Dwyer, Stableman
William Eagen, Gardener
James Finley, Gardener
John Finley, Foreman Gardener
Margaret Finley
George Friedhoff, Gardener
A. Gleasel, Gardener
Sarah H. Harlow, Librarian
Marshall A. Howe, Curator
R. McLaughlin, Gardener
J. Moore, Gardener
W. A. Murrill, Assistant Director
George V. Nash, Head Gardener
John Purcell, Gardener
Jacob Radlein, Gardener
F. A. Schilling, Museum Custodian
F. J. Seaver, Curator
Harry Shafer, Gardener
J. K. Small, Head Curator

John Sommer, Gardener
A. B. Stout, Director of the Laboratories
W. Von Gerichten, Keeper
Florence M. Willey, Stenographer
Ralph Willey, Driver
R. S. Williams, Administrative Assistant
Percy Wilson, Associate Curator

Application of the Several Sources of Revenue

1. *City Allowance for Maintenance*

The city appropriation for maintenance of grounds, buildings and collections for 1917 was $109,760, and was expended for salaries, wages, supplies and material.

2. *General Income Account*

The General Income Account is made up of the income of the Endowment Fund (principal about $305,000), amounting to about $13,000, to which is added membership dues and sundry receipts aggregating about $11,000, or about $24,000 in all.

This income was for the most part expended for salaries, wages, supplies and material, to supplement the city maintenance allowance. A small portion of it was used for plans, surveys and construction.

3. *Science and Education Fund*

This fund was contributed by members and friends of the Garden in 1913, specifically for educational and scientific purposes, and some additions have since been made to it by gift and bequest, the principal now being $83,455, yielding about $4,000 annually.

The income has been expended for publications, lectures, photography, laboratory supplies and equipment, and a small amount for exploration.

4. *Darius Ogden Mills Fund*

A bequest of $50,000 made by Mr. Mills, who was for many years President of the Board of Managers, received in 1910, which yields about $2,200 annually.

This income has been used for museum and herbarium materials, books, binding, and for the expenses of investigations made by members of the staff at other institutions.

5. *David Lydig Fund*

A bequest of Judge Charles P. Daly, received in 1901, yielded $34,149.86. Its income is about $1,400 annually, and is specified for publications; to this income we add sums derived from the sale of publications, amounting to about $3,000 annually.

The publication of the *Bulletin*, *Contributions*, and *Journal* have been aided by the income of this fund.

6. *Maria DeWitt Jesup Fund*

A bequest by Mrs. Maria DeWitt Jesup of $25,000, received during 1915, 1916 and 1917, yields about $1,100 annually.

The income is specified for the increase of the collections, and has been expended for books and specimens.

7. *Addison Brown Fund*

A bequest by Judge Addison Brown, for many years President of the Board of Managers, received in 1914, yielded $21,800; the income (aided by subscriptions) is specified for the publication of colored illustrations of plants.

The income has been used as specified by the publication of *Addisonia;* this income is about $900, to which about $2,500 received from subscriptions to the publication was added in 1917.

8. *William R. Sands Fund*

A bequest of $10,000, received from William R. Sands in 1909, yields about $400 annually.

The income is used for horticultural prizes, awarded at exhibitions held at the Garden.

9. *Henry Iden Fund*

A bequest of $10,000, received in 1913 from Henry Iden, yields about $400 annually.

The income, specified for students' research scholarships, has been used to aid the work of several deserving students.

10. *John Innes Kane Fund*

In 1913, Mrs. Annie C. Kane established a fund of $10,000 as a memorial of her husband, John Innes Kane, long a member of the Board of Managers, specifying the use of its income for the purchase of plants for the grounds and greenhouses.

This income, about $500 annually, has been expended for the purposes specified.

11. *Students Research Fund*

Fees received from students of the Garden are accumulated to form the principal of a Students Research Fund, which now amounts to about $4,000, and yields about $175 annually.

The income is used in the form of grants to aid the investigations of deserving students.

12. *Olivia E. and Caroline Phelps Stokes Fund*

In 1901, the Misses Phelps Stokes contributed a fund of $3,000 for the preservation and protection of native plants. The income, about $120 a year, was used in 1917 for the preparation of lantern slides illustrating native plants which should be preserved.

13. *Charles Budd Robinson Fund*

Dr. Charles Budd Robinson, one of the Garden's first students, was killed on the Island of Amboina, Dutch East Indies, in December, 1913, while an official of the Bureau of Science of the Philippine Islands, and a most promising scientific career was thus lamentably terminated. A fund, which now aggregates $652.30, was subscribed by friends

and associates as a memorial, and is held open for additional subscriptions. Dr. Robinson's sister has recently contributed a considerable number of valuable botanical books, which she desires to have sold and the proceeds added to the fund.

The income is specified to aid botanical exploration. In cooperation with officials of the Philippine Island Bureau of Science, a grant of $50 has been made from this income for use in obtaining further knowledge of the flora of the Island of Guam.

Reports Appended

Following this report will be found those of the Assistant Director, the Head Gardener, the Head Curator of the Museums and Herbarium, the Librarian, the Bibliographer, the Director of the Laboratories, the Supervisor of Gardening Instruction, the Superintendent of Buildings and Grounds, the Honorary Curator of the Economic Collections, the Honorary Curator of the Collection of Fossil Plants, and the Honorary Curator of Mosses; also a list of subscriptions to the Emergency Fund subscribed by members during 1917, and a schedule of expenditures by the Bookkeeper.

Respectfully submitted,

N. L. Britton,

Director-in-Chief.

REPORT OF THE ASSISTANT DIRECTOR

Dr. N. L. Britton, Director-in-Chief.

Sir: I have the honor to submit the following report for the year 1917.

The weekly reports of the Superintendent are submitted herewith for your files to supplement the annual reports to follow, which include only the more important details of maintenance for the year.

The season of 1917 was remarkable for its cold, wet spring, being two weeks or more later than the average. There were no floods of any consequence, but a rather violent storm occurred in October which uprooted 27 trees.

Work on the control of the more destructive insect pests has been continued during the entire year, under the supervision of Dr. Seaver, special attention having been given to the tussock moth, since this insect has been unusually abundant for two seasons past. Hand picking of the egg-masses and daubing them with creosote were tried during the winter and early spring in order to prevent the hatching of the insects. This was supplemented by the spraying of the trees during the entire growing season in order to destroy the larvae which escaped the first treatment.

The rose beetle remained very destructive and hand picking has been resorted to in order to protect the more valuable roses and other shrubs. The pine-shoot moth continues to be very destructive to certain pines, especially the dwarf forms. Removing the infected shoots seems to be the only practical remedy and this is not very effective.

Attention has also been given to the control of destructive fungi. The application of sulphur was resorted to in the new rose garden as a preventive of rose mildew and was found effective. Other fungous diseases are being investigated and efforts made to control them. Many poplars have been attacked by the poplar canker, which is a serious disease and not amenable to any ordinary treatment.

Publications

Journal

The *Journal* has been published for each month during the year, making a volume of 291 pages, with 19 plates.

Mycologia

This periodical has appeared on alternate months during the year, making a volume of 374 pages, with 15 plates.

North American Flora

Volume 10, part 2, containing descriptions of Agaricaceae (pars), by W. A. Murrill, appeared April 26, 1917.

Volume 21, part 2, containing descriptions of Amaranthaceae, by Paul C. Standley, appeared June 9, 1917.

Volume 10, part 3, containing descriptions of Agaricaceae (pars), by W. A. Murrill, appeared June 25, 1917.

Bulletin

Bulletin No. 35, with 110 pages, was issued April 10, 1917. It contains the annual reports of the Director-in-Chief and other officers for the year 1916.

Bulletin No. 31, completing the eighth volume of this publication, appeared July 10, 1917. It contains two scientific papers, one by R. S. Williams on "Philippine Mosses" and the other by Percy Wilson on "The Vegetation of Vieques," together with the table of contents and indexes to the volume.

Addisonia

The second volume of this publication, containing 84 pages of popular descriptions and 40 colored illustrations of plants, appeared in four parts, issued in March, June, September, and December.

Contributions

No. 193. A Note on the Structural Dimorphism of Sexual and Tetrasporic Plants of Galaxaura obtusata, by Marshall A. Howe.

No. 194. El Genero Rynchospora Vahl, En Cuba, by Nathaniel Lord Britton.

No. 195. Studies of West Indian Plants—IX, by Nathaniel Lord Britton.

No. 196. Notes on Rosaceae—XI, by P. A. Rydberg.

No. 197. Notes on North American Species of Riccia, by Marshall A. Howe.

No. 198. Fertility in Cichorium Intybus: The Sporadic Occurrence of Self-fertile Plants among the Progeny of Self-sterile Plants, by A. B. Stout.

No. 199. Notes on Plants of the Southern United States—III, by Francis W. Pennell.

No. 200. Fertility in Cichorium Intybus: Self-com-

patibility and Self-incompatibility among the Offspring of Self-fertile Lines of Descent, by A. B. Stout.

No. 201. Notes Regarding Variability of the Rose Mallows, by A. B. Stout.

No. 202. Phytogeographical Notes on the Rocky Mountain Region—VII. Formations in the Subalpine Zone, by P. A. Rydberg.

No. 205. Observations on Tulips, by A. B. Stout.

Lectures

Public Lectures

Illustrated public lectures on botanical and horticultural subjects have been given in the museum building on Saturday afternoons from April to October, as outlined below. The total attendance for the year was 2,332, averaging 90 for each of the 26 lectures; the maximum attendance being 188 on April 28.

April 28. "Early Spring Flowers," by Dr. N. L. Britton.

May 5. "School and Home Gardening Courses at the New York Botanical Garden," by Mr. Henry G. Parsons.

May 12. "The Spring Flower Garden," by Mr. G. V. Nash.

May 19. "Garden Soils and Their Treatment," by Professor H. F. Button.

May 26. "Modern Methods of Producing Seeds for Farm and Garden," by Dr. A. B. Stout.

June 2. "Vacant Lot Gardening," by Mr. Carl Bannwart.

June 9. "Garden Roses," by Professor A. C. Beal.

June 16. "The Seaweeds of New York and Vicinity," by Dr. M. A. Howe.

June 23. "Lilies for Everybody," by Mr. Arthur Herrington.

June 30. "The Food Value of Wild Mushrooms," by Dr. W. A. Murrill.

July 7. "Wild Flowers of Summer," by Dr. N. L. Britton.

July 14. "Plants Grown by the American Indians," by Dr. A. B. Stout.

July 21. "Flowers for the Summer Garden," by Mr. G. V. Nash.

July 28. "How the Introduction of Foreign Plant Diseases is Prevented," by Mr. H. B. Shaw.

August 4. "Floral and Scenic Features of Cuba," by Dr. M. A. Howe.

August 11. "Books on Gardening," by Dr. J. H. Barnhart.

August 18. "Trees and Flowers of the Yellowstone National Park," by Dr. P. A. Rydberg.

August 25. "Insect Enemies of Plants," by Dr. F. J. Seaver.

September 1. "Collecting Fungi in the Catskills," by Dr. W. A. Murrill.

September 8. "The Origin and History of Soils," by Dr. A. Hollick.

September 15. "Growing Fresh Vegetables in the Back Yard," by Mr. H. G. Parsons.

September 22. "Some Botanical Features of Northern Cape Breton," by Dr. G. E. Nichols.

September 29. "Growing Nut Trees," by Dr. W. C. Deming.

October 6. "Autumn Coloration," by Dr. A. B. Stout.

October 15. "The Relation of Forests to Water Supply," by Dr. G. C. Fisher.

October 20. "Fall Planting and Winter Protection," by Mr. G. V. Nash.

Lectures to Members

Illustrated lectures by members of the Garden staff and other experts, followed by excursions to various parts of the grounds, were given at the Mansion at 3 o'clock on Thursday afternoons in February, March, and April, and on Wednesday afternoons in November, as follows:

February 1. "Cactuses."
February 8. "Winter Fruits."
February 15. "Conifers."
February 22. "Bromeliads—The Pine-apple Family."
March 1. "Ferns."
March 8. "Palms."
March 15. "Aroids—The Calla-lily Family."
March 22. "Orchids."
March 29. "Early-flowering Shrubs."
April 5. "Early-flowering Trees."
April 12. "Spring Bulbs."
April 19. "Early Perennials."
April 26. "Roses and the New Rose Garden."
November 7. "Recent Construction and Development of the Garden by the Aid of Gifts from Mr. Daniel Guggenheim, Mr. Murry Guggenheim, Mr. Edward D. Adams, Mrs. Frederick F. Thompson, Mrs. Robert E. Westcott, and the Emergency Fund Subscribed by Members."
November 14. "The New Rose Garden and Plans for Its Further Development; the 'Convention Garden' and Plans for Its Modification into Special Horticultural Plantations; and Plans for the New Plantations of Lilacs, Peonies, and Dahlias."
November 21. "The School Garden and the Work of the Garden School."
November 28. "Educational and Investigational Work of the Garden."

Docentry

Nearly 2,000 visitors, including classes from public and private schools, have availed themselves during the year of the privilege of viewing the buildings and grounds under the guidance of Mr. Percy Wilson, Mr. R. S. Williams, and Mr. H. W. Becker.

Nature Study

On January 23 and 25 and June 19 and 21, a total of about 2,000 biology pupils from Evander Childs High School and Morris High School, accompanied by their

teachers, came to the Garden for special study of certain collections under the guidance of members of the staff, after which they attended illustrated lectures on forestry given in the public lecture hall by Mr. George E. Hewitt and Mr. George H. Sherwood.

On July 26, about 50 students from the summer school of Columbia University made an excursion through the grounds and buildings of the Garden, which was led by Mr. W. L. Crawford, Mr. George Meredith, and several members of the Garden staff.

Scientific Meetings

The monthly conferences of members of the staff and students have been continued, and a report of each meeting has been published in the current number of the *Journal*.

The Torrey Botanical Club has met each month as usual in the morphological laboratory in the museum building.

The Horticultural Society of New York, in cooperation with the New York Botanical Garden, held exhibitions of plants and flowers in the museum building on May 12 and 13, June 9 and 10, July 14 and 15, and September 22 and 23.

A field meeting of the Department of Botany of the Brooklyn Institute of Arts and Sciences was held at the Garden on the afternoon of April 28, about 75 members being in attendance.

The New York Library Club held its annual meeting at the Garden on May 10, with about 200 members present.

A field day for garden-club members was held at the Garden on May 21 under the auspices of the Garden Club of America.

The American Association of Museums held a field meeting at the Garden on May 25.

The American Gladiolus Society met at the Garden on August 24 and held its exhibition here August 23–26.

The Torrey Botanical Club held one of its Fiftieth Anniversary meetings at the Garden on October 19.

Personal Investigations

Two parts of *North American Flora*, containing descriptions of 606 species of the higher fleshy fungi, 183 of which were new, were published during the year.

The popular illustrated articles on fungi in *Mycologia* have been continued with the aid of colored plates prepared by Miss Eaton, 16 species having been treated in this series during the year.

The usual routine of herbarium work and the ever-increasing number of requests for the determination of specimens have consumed much time.

Very little field work has been possible. During a vacation of two weeks at Delaware Water Gap, I obtained about 300 specimens and sufficient information for a preliminary report on the fungi of that locality.

Respectfully submitted,

W. A. MURRILL,
Assistant Director.

REPORT OF THE HEAD GARDENER

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to submit herewith my report as Head Gardener for the year 1917.

Systematic Plantations

HERBACEOUS GROUNDS. The herbaceous collections comprise about 3,050 species and varieties, contained in 130 beds, 26 east of the brook and 104 west. In addition to the above there are 50 species in the American wood garden not represented here. There have been 593 show labels placed here.

Mr. K. R. Boynton, Head Gardener's Assistant, has been in charge of the details of the curatorial work here and in the other herbaceous collections.

FRUTICETUM. There are 2,810 specimens here, representing, including those still at the nurseries, 52 families, 140 genera, and 1,024 species and varieties. There are in

addition two genera and two species in the American wood garden, not represented here. 140 show labels have been added.

SALICETUM. The collection here comprises 139 specimens, representing two genera and 37 species and varieties.

DECIDUOUS ARBORETUM. This collection, including those native to the tract and those still in the nurseries, comprises 405 species and varieties. There are 1,053 individual trees, representing 31 families and 59 genera. For this collection there have been made 162 show labels.

PINETUM. There are 3 families and 20 genera shown here. There are 1,651 specimens, and about 261 species and varieties. 525 show lables have been placed here.

VITICETUM. There are here about 50 species and varieties. 6 show labels have been put here.

CONSERVATORIES. The collections under glass comprise about 9,311 species and varieties, representing 207 families and 225 genera. The number of plants in the public conservatories is 16,953, somewhat less than last year, as the number of duplicates is being constantly reduced.

Range 1. There are here 10,317 specimens, as follows: house 1, 335; house 2, 414; house 3, 475; house 4, 573; house 5, 1,400; house 6, 523; house 7, 770; house 8, 789; house 9, 144; house 10, 878; house 11, 459; house 12, 1,145; house 13, 507, house 14; 698; house 15, 1,098; cellar, 109. 1,017 show labels have been made for the collections here.

Range 2. There are here 6,636 plants, distributed as follows: house 1, 79; house 2, 160; house 3, 60; house 4, 1,560; house 5, 1,884; house 6, 1,412; house 7, 1,228; runway and cellar, 253. 868 show labels have been placed here.

PROPAGATING HOUSES AND NURSERIES. There are here 8,459 plants, excluding those used for special studies by the Director of the Laboratories. 591 packets of seeds have been received, as follows: gift, 13; purchase, 260; exchange, 249; collected, 69. In addition to the above there have been collected on the grounds 350 packets.

LABELING, RECORDING, AND HERBARIUM. This work has been accomplished by one gardener and an apprentice. Accession numbers 45,195 to 45,907 have been recorded, making a total of 713 accessions. The following show labels have been made, a total of 5,005; deciduous arboretum, 162; fruticetum, 140; herbaceous grounds, 593; economic garden, 40; morphologic garden, 28; rose bed, 61; iris garden, 210; pinetum, 525; trees along roads and paths, 276; conservatory flower beds, 397; conservatory range 1, 1,017; conservatory range 2, 868; pools in court of conservatory range 1, 15; convention garden, 79; salicetum, 105; rose garden, 447; school farm, 42.

There have been the following accessions of plants: by gift, 10,880 (of which 10,495 are bulbs and corms), valued at about $1,070; by exchange, 451; by purchase, 8,304 (including 8,000 bulbs); by collections made by members of the staff and others, 974; derived from seeds from various sources, 850; total, 21,459.

There have been 550 specimens added to the herbarium of cultivated plants. The collections contain approximately, including those native to the tract, the following number of species and varieties: conservatories, 9,311; herbaceous grounds, including 50 kinds in the American wood garden not represented here, 3,100; fruticetum, including those at the nurseries, 1,024; salicetum, 37; deciduous arboretum, 405; pinetum, 261; viticetum, 50; total, 14,188.

Miscellaneous Collections

Here are included the following: morphologic garden; economic garden; collections of desert plants placed during the summer in the court of conservatory range 1; conservatory lily pools; aquatic garden; rhododendron collections in the vicinity of the lakes, at conservatory range 1, and in front of the Museum; rose bed, east of conservatory range 1; flower gardens in the immediate vicinity of conservatory range 1, at the Elevated approach, and the west border; American wood garden; iris garden; magnolia garden; American thorn garden; white pine plantation.

Lilac and Peony Garden. This, begun in the fall of 1916, has been further developed by the addition of a collection of 96 specimens, formerly located in the vicinity of the ashes in the arboretum.

Rose Garden. The rose garden, being developed in cooperation with the Horticultural Society of New York, was the most important piece of new work accomplished. Of the beds provided for in the original plan 94 have been opened and planted; they have a total area of about 17,650 square feet, or a little over two fifths of an acre. The number of plants required to fill these beds is 4,800. In this collection of roses there are at present 422 kinds, representing 13 classes. The agreement with the Horticultural Society requires that organization to furnish the rose plants. The roses now in the garden have been donated to the Horticultural Society by the following: Bobbink & Atkins, Rutherford, N. J.; F. R. Pierson Co., Tarrytown, N. Y.; A. N. Pierson, Inc., Cromwell, Ct.; H. A. Dreer, Philadelphia, Penn.

Each kind of rose is provided with a label giving information as to the class of rose, its name, and, in the case of those given, the name and address of the donor. 447 such lables have been prepared, adding at once a great educational value to the garden which is being developed as a collection of roses, where a large assortment will be shown, thus giving rose lovers an opportunity of seeing and comparing many kinds.

It will require between 1,000 and 1,200 more rose bushes to complete the planting of the remainder of the beds planned for the area included within the boundary walks. The proposed enclosing fence was planned to accommodate the rambler roses. There is about 900 feet of this fence required, upon which could be grown about 150 roses. Messrs. Bobbink & Atkins, of Rutherford, N. J., have offered a large collection of this type of rose to the Horticultural Society of New York as soon as provision is made by the Garden for their reception.

Convention Garden. The convention garden of the Society of American Florists and Ornamental Horticulturists, located to the south of the herbaceous grounds, was developed during the late spring and early summer. There were 32 beds, occupied by 16 exhibitors. Those interested commercially in plants did not take as active an interest in the success of the garden as might have been desired.

General Horticultural Operations

For the carrying on of this work the following force has been available: monthly, 2 foreman gardeners, 27 gardeners, and 5 drivers; laborers, about 22.

Foreman gardener John Finley has been in charge of the outside work; 10 gardeners, the drivers, and the laborers were assigned to him.

In the conservatories and propagating houses the work has been in charge of foreman gardener H. W. Becker, to whom were assigned 17 gardeners.

During the year there has been accomplished, in addition to the regular routine operations, the following new work:

In the Spring

The planting of conifers, secured by purchase, in the pinetum to replace those killed during the previous winter, and the completion of the planting of the Chamaecyparis triangle to the west of conservatory range 1. The planting in the arboretum and fruticetum of a number of species not before represented in those collections. The development of the rose garden and convention garden, already referred to.

In the Fall

The further development of the lilac and peony garden, already referred to, by the incorporation of 96 more lilac bushes. The addition to the arboretum of a number of kinds of trees, obtained by purchase, not hitherto represented there. The further development of the rows of Gingko trees west of the Museum. The planting of a red

oak along the main driveway south of the Museum, and the planting of another along the driveway west of the west lake, in place of a tree of Koelreuteria, destroyed on account of defects. The planting of about 16,500 tulip bulbsin beds in the court of conservatory range 1, the circular bed in the plaza at conservatory range 1, and at the fountain at the foot of the Museum approach. The 3,000 of these placed in the plaza bed are the cottage tulip Fawn, given by John Scheepers & Co., Inc.

Investigations and Lectures

In addition to routine duties, I have continued my orchid studies and have been occupied particularly with horticultural botany especially in its relation to the hardy woody plants of the Garden collections.

I have given three of the lectures of the regular public courses at the Garden. My work of superintending the making of colored drawings for *Addisonia* has been continued, and I have acted, with Dr. Barnhart, as one of the editors of that publication.

Respectfully submitted,

GEO. V. NASH,
Head Gardener.

REPORT OF THE HEAD CURATOR OF THE MUSEUMS AND HERBARIUM

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I submit herewith my report as Head Curator of the Museums and Herbarium for the year 1917.

The several exhibits and research collections under my supervision were cared for and developed by the methods and on the same lines as in former years. The additions to the various collections were given in detail in several of the numbers of the *Journal* during the year. The following table will give a summary statement of the accessions for the year:

By gift and purchase	2,505
By exchange	13,623
By exploration	6,286

Consequently, 22,414 herbarium and museum specimens were brought together. The value of the specimens received as gifts is estimated at $129.30.

Fully 1,000 specimens were sent to other institutions and to individuals in exchange.

Museums

There were no additions to the museum equipment; but miscellaneous specimens were added to the several divisions of the public exhibits.

THE ECONOMIC MUSEUM was augmented by miscellaneous specimens and by a set of several dozen specimens of food plants acquired by Dr. Rusby in Colombia, and presented by him to the Garden.

THE SYSTEMATIC MUSEUM, comprising: (a) *The Synoptic Collection*, (b) *The Local Flora*, (c) *The Microscope Exhibit*, and (d) *The Plant Picture Exhibit*, was improved by the interpolation of specimens, by renovation, and by some relabeling.

THE FOSSIL PLANT MUSEUM was increased by the addition of a few specimens and by considerable renovation of the exhibits formerly installed. For further notes see Report of the Honorary Curator of Fossil Plants.

Herbaria

Miscellaneous specimens from both the Old World and the New were received for the herbarium. The more valuable additions came from the United States, Central America, and South America. The geographical origin of the specimens is given in the accession lists published from month to month in the *Journal*.

About 9,200 sheets of mounting paper were used. Fully 30,000 flat specimens were incorporated in the herbarium cases and several hundred bulky specimens were put away in cardboard boxes. A few specimens received for the Columbia University herbarium were incorporated in that collection. In addition to preparing new material

for the collections, considerable time and attention was devoted to conserving special groups already incorporated.

Investigations and Assistance

Dr. P. A. Rydberg, Curator, had charge of the collections of flowering plants. He continued his monographic work on the families Rosaceae, Fabaceae, and Carduaceae, and also on the flora of the Rocky Mountain region. The manuscript of several parts of *North American Flora* are essentially ready to go to press. Dr. Rydberg printed a paper on the roses of California under the title, "Notes on Rosaceae—XI" and has put his studies of the Rocky Mountain flora on record in the form of a manual entitled "Flora of the Rocky Mountains and Adjacent Plains," which has just been issued from the press. He also published an article "Phytographical Notes on the Rocky Mountain region—VII."

Dr. Marshall A. Howe, Curator, has continued to have charge of the collections of algae and hepaticae in the Herbarium and Museums and also of the exhibition microscopes in the Systematic Museum. A considerable increase in the collection of microtome sections of calcareous algae as well as in the general collections of algae and hepaticae has been made. Dr. Howe has contributed a systematic treatment of the algae of Bermuda to Dr. Britton's "Flora of Bermuda" and shorter papers have been published under the titles "Some Economic Uses and Possibilities of the Seaweeds" and "Notes on North American Species of Riccia."

Dr. Fred J. Seaver, Curator, remained in charge of the fungous collections. Research on the cup-fungi of North America for *North American Flora* has been continued. In this connection about five hundred specimens of this group from the herbarium of C. G. Lloyd have been looked over and determined and duplicates of the more interesting species retained for the Garden herbarium. Local collecting and determination of miscellaneous collections of

fungi sent in have been continued, including numerous specimens from Porto Rico collected by Mr. J. F. Stevenson. Several students have carried on investigations on fungi at the Garden during the year under his supervision who are looked to eventually for assistance on *North American Flora.* A number of papers have been published during the year. Work on fungous diseases and insect pests has been continued (see report of the Assistant Director) and one lecture delivered on the latter subject.

Mr. Percy Wilson, Associate Curator, has devoted considerable time to determining and distributing West Indian plants. In the *Bulletin of the New York Botanical Garden,* issued in June, he published a paper on "The Vegetation of Vieques Island," in which a comparison of its flora is made with that of the adjacent islands of Porto Rico, Culebra, St. Thomas, and St. Croix. He has also studied and determined for other institutions many specimens of tropical plants on which parasitic fungi occur. Mr. Wilson has continued his supervision of the lantern-slide and negative collections, and all photographic work. His duties as docent have been greatly increased as a larger number of classes for both public and private schools are taking advantage of the opportunity of viewing and studying the collections under special guidance. The Local Flora collection has been greatly increased by the addition of many specimens obtained on the various excursions of the Torrey Botanical Club, of the Field Committee of which Mr. Wilson has been chairman for several years.

Dr. Francis W. Pennell, Associate Curator, active during the first half of the year, on leave during the second half, continued to have editorial supervision of the *Journal* for the earlier months of the year and continued his studies in the figwort family. He made an extensive trip for field work on that group, visiting South Carolina, Georgia, Florida, Alabama, Tennessee, and Virginia. Dr. Pennell published several papers on miscellaneous plants of the

southeastern states and devoted some time to the local flora. He gave one lecture in the regular Garden lecture course.

Dr. H. H. Rusby, Honorary Curator of the Economic Collections, continued to develop the collections of the Economic Museum. See his report.

Mrs. N. L. Britton, Honorary Curator of Mosses, continued, with the coöperation of Mr. R. S. Williams, Administrative Assistant, to develop the moss herbarium. See her report.

Dr. Arthur Hollick, Honorary Curator of Fossil Plants, continued in charge of the paleontological collections. See his report.

The writer, in addition to general and special curatorial duties, devoted some time to monographic work on *North American Flora.* Exploration in Florida was carried on in hitherto botanically unknown regions and special attention was devoted in the field to certain groups of plants, such as the cacti, the palms, the flowering air-plants, and the ferns.

Respectfully submitted,

JOHN K. SMALL,

Head Curator of the Museums and Herbarium.

REPORT OF THE LIBRARIAN

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to submit the following report for the year 1917.

The census taken at the end of the year shows 28,534 bound volumes, a net gain of 895 over the census of a year ago.

During the year 545 books have been bound, including 34 which are the property of Columbia University.

The accessions have been listed as usual in the *Journal.* These include 110 books acquired by purchase and 151 by gift. The exchanges and deposits number 128, while there have been permanently recalled by Columbia 29 volumes.

In June, the Garden was the recipient of 218 volumes, including several valuable duplicate sets. These books, the gift of Mr. Nathaniel T. Kidder of Boston, were specially listed in the July number of the *Journal.*

There have been added to the catalogue during the past year 1,136 written and typewritten cards, in addition to the printed cards issued by the Torrey Botanical Club. Considerable work has been done upon the revision of the catalogue and many apparently superfluous subject cards withdrawn.

A letter recently received from our agent in charge of foreign periodical subscriptions reads, as follows: "The British Foreign Office has given instructions to release all publications of enemy origin in detention, so far as they are addressed to universities or public institutions of the United States, and has announced the termination of the permit arrangement. Accordingly, parcels held in London may be expected at any time, but shipments stored at Rotterdam while now on shipboard there, must wait the conclusion of the embargo negotiations with Holland. A solution is declared imminent."

The following additions should be made to the list of periodicals as appended to the report of the Librarian for 1916 (*Bulletin* 9: 342–363):

Add the following:

International Garden Club, New York, N. Y. *Journal.*
Jalta. Jardin Imperial de Nikita, Jalta, Russia. *Seed Lists, Acta Florae Rossicae.*
* Journal of Forestry, Washington, D. C.
Lorquinia, Los Angeles, Cal.
New York State Forestry Association, Syracuse, N. Y. *New York Forestry.*
Sociedad Geografica de Lima, Lima, Peru. *Boletin.*
* Soil Science, Baltimore, Md.

Respectfully submitted,
SARAH H. HARLOW,
Librarian.

REPORT OF THE BIBLIOGRAPHER

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to submit the following report for the year 1917.

The usual bibliographic study, correspondence, and library assistance have been continued throughout the year. The development of the library has been chiefly by gifts and exchanges, little money being available for the purchase of books.

Only 3 parts of *North American Flora* have been issued during the year: Volume 10, Part 2, in April, and Volume 21, Part 2, and Volume 10, Part 3, in June. Volume 21, Part 3, is nearly ready to appear. More manuscript is in hand and in sight than at any time before, and it is hoped that 1918 may be a record year in the progress of the *Flora*. The second volume of *Addisonia* has been completed, in four parts of ten plates each.

Historical studies have consumed rather more of the Bibliographer's time this year than usual. In May, at the Centennial Meeting of the New York Academy of Sciences, he presented a historical sketch of the Academy; this was published in the *Scientific Monthly* for November. In October the Torrey Botanical Club celebrated its semi-centennial with a series of meetings, which opened with a sketch of the history of the Club by the same writer. Both historical sketches were brief, but no little study was necessary to insure their accuracy. A series of biographical notes on the botanists of Charleston, South Carolina, appeared in the Garden *Journal* for November; and a list of authors, upon a scale never before attempted in a work of this kind, was prepared for Rydberg's "Flora of the Rocky Mountains," which appeared on the last day of the year.

Respectfully submitted,

JOHN HENDLEY BARNHART,

Bibliographer.

REPORT OF THE DIRECTOR OF THE LABORATORIES

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to submit the following report for the year 1917.

General Matters

The equipment and facilities of the laboratories, experimental plots, and propagating greenhouse have been continued on the same basis as in the previous year. The purchase of new supplies has been much reduced and no new projects have been undertaken which have entailed special expenditures. Various experimental studies have fully utilized all available space in greenhouse, cold frames and experimental plots.

Meteorological records have been taken and placed on file. Programs for the monthly conferences of the scientific staff and students of the Garden have been arranged and reports of such conferences published in the *Journal.*

Personal Investigations

Cultures of *Cichorium Intybus* have been grown for further study of incompatibilities in function of sex organs and for further data regarding fasciation. The statistical studies of flower number per head, vigorously prosecuted since 1912, have now been completed and during the year manuscript presenting the results has been prepared.

Studies with *Hibiscus*, *Verbascum*, and *Plantago* have been continued along lines previously reported. Cultures of *Reseda*, *Nicotiana*, *Papaver*, *Ammocallis*, *Lythrum*, and *Phlox subulata* have been grown for various lines of investigation.

With your permission field studies of the natural distribution of *Hibiscus* were made during August. A general survey was made of wild *Hibiscus* growing along the New Jersey coast from Cape May to the Tuckahoe River. What appears to be a pure stand of *Hibiscus oculiroseus* several acres in extent was found along the Tuckahoe River and Cedar Creek. Presque Isle on the coast of Lake

Erie and marshes along the Seneca River near Savannah and Weedsport, New York, were also visited. Plants typical of the various forms of *Hibiscus* found at various localities were obtained and are now planted in the experimental plots. Further prosecution of field studies are highly desirable.

The display plantings of tulips have been utilized in observations on blindness, on development of rots, and on the appearance of excessive and abnormal growth. Some points of practical interest have been determined regarding methods of treatment and the value of various varieties for this locality.

During the year five articles, three of which are contributions, have been published covering various phases of research. Three other articles have been submitted for publication.

Special Investigators, Students, and Scholars

Of the visiting investigators in residence during part of the year mention should be made of Professor Henri Hus, Professor John W. Ritchie, and Mr. C. H. E. Redding. The two last-named have pursued experimental studies necessitating use of space in greenhouse and experimental plots. Numerous persons have spent various periods of time at the Garden, especially in studies in the herbarium or the library.

Facilities of experimental plots were used by Professor R. A. Harper in growing corn for studies in heredity and by Mr. Raines for growing cereals in prosecuting studies of rust infections.

List of students

The following were formally registered as students pursuing studies in most cases for degrees. All satisfied tuition charges either at Columbia University or at the Garden:

Adams, James Fowler. *Pathology.*
Berman, Florence Julia. *Variegation in Tussilago.*

BRAUN, HARRY. *Pathology. Genetics.*
HAZEN, ELIZABETH LEE. *Thesis on self- and cross-pollination.*
HEWITT, GEORGE EDWARD. *Pathology.*
HORNE, WILLIAM TITUS. *Pathology. Mycology.*
NISHIMURA, MAKATO. *Pathology.*
NIXON, ERNEST LELAND. *Genetics.*
ORTON, CLAYTON ROBERTS. *Pathology. Mycology.*
QUERO, FELIX GALLEGO. *Genetics. Pathology.*
REED, MERRILL VIRGIL. *Genetics.*
SCHEAR, EDWARD WALDO EMERSON. *Genetics.*
STOWELL, WILLARD ALLEN. *Genetics.*
TAISTRA, SOPHIE AMY. *Genetics.*
TWISS, WILFRED CHARLES. *Pathology.*

LIST OF SCHOLARS

ANDREWS, A. LEROY. Month of August. *Mosses.*
ARTHUR, JOSEPH C. Month of January. *Rusts.*
FITZPATRICK, HARRY M. Month of August. *Mycology.*
JACKSON, HERBERT S. Month of January. *Rusts.*
ORTON, CLAYTON R. Month of July-August. *Mycology*
OVERHOLTS, LEE O. Month of August. *Mycology.*

Respectfully submitted,
A. B. STOUT,
Director of the Laboratories.

REPORT OF THE SUPERVISOR OF GARDENING INSTRUCTION

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to submit the following report for the year 1917.

In accordance with the correspondence and agreement between The International Children's School Farm League and the Board of Managers of the New York Botanical Garden published in the March issue of the Garden *Journal*, for 1917, the Garden School was instituted and put in operation April 1, 1917, with office and lecture and laboratory class-rooms at the mansion, and with an out-door garden a short distance to the east of the mansion, suitably laid out for individual and class instruction. There was a total of fifty-nine students in all classes.

The plan was to offer a definite course to train persons to conduct School Gardens (thirty three-hour periods in six weeks), and to give a certificate upon a satisfactory completion; which was done successively:

April 2 to May 11, 1917, with eight students
May 14 to June 22, 1917, with seven students
July 9 to August 17, 1917, with three students

Also to give instruction in Home Gardening at hours, and in ways, that would meet the needs of earnest students of limited spare time; and this was done, as follows:

A course of five weekly one-hour lectures in April to fourteen students
A course of five weekly one-hour lectures in May to fifteen students
A course of six weekly three-hour periods of garden practice in September and October to five students
A course of six weekly three-hour periods of greenhouse practice in November and December to seven students

A Small Home Vegetable Garden, twenty by fifty feet, was maintained for instruction and observation of students and visitors (See Garden *Journal* for August, 1917).

Lectures were delivered on the Home Vegetable Garden before Garden Clubs in New Rochelle and Staten Island, N. Y., and in Princeton, N. J.

The work of all students showed great earnestness and interest, and the average attendance was high.

List of Students in all Courses

Mrs. E. H. Anderson.....Scarsdale, N. Y.
Mrs. William H. Andrews.....130 East 67 Street.
*Mr. Miner Barcus.....East Orange, N. J.
Miss M. I. Barrow.....131 East 69 Street.
Mrs. P. G. Bartlett.....660 Park Avenue.
Miss Florence I. Benjamin.....503 West 121 Street.
Mrs. Helen Biddle Griscom Bettle.....101 East 72 Street.
Miss H. C. Blake.....128 Central Park South.

* Registered in two courses.

*Mrs. E. C. Bodman.....835 Madison Avenue.
Miss Agnes I. Buckley.....1246 Morris Avenue.
Miss Ethel Burnett.....937 Madison Avenue.
Miss Helen Cameron.....20 East 84 Street.
Miss Jennie V. Coombs.....Scarsdale, N. Y.
Mrs. M. LeBrun Cooper.....55 East 66 Street.
Miss May Corbett.....Montclair, N. J.
Miss Florence Edelmuth.....1046 Jackson Avenue.
Mrs. Helen M. Fox.....150 West 86 Street.
Miss Netta L. Frank.....2 East 56 Street.
Mrs. Albert Fries.....9 West 82 Street.
Miss Gail Gardner.....14 West 65 Street.
Mrs. John Gass.....178 East 64 Street.
Miss Freda Gottlieb.....1175 Clay Avenue.
Mrs. Alice S. Grant.....Ridgewood, N. J.
Miss Edith Haas.....7 East 69 Street.
Miss Lillian Hart.....528 West 182 Street.
Miss Sybil T. Hirsch.....White Plains, N. Y.
Miss Anne S. Hoyt.....Bronxville, N. Y.
Miss Louise E. Jocelyn.....415 West 118 Street.
Miss Ethel King.....20 East 84 Street.
Mrs. Warren Kinney.....Butler, N. J.
Miss Helene V. Konermann.....Mt. Vernon, N. Y.
Miss Mary V. Linden.....226 West 75 Street.
Miss Harriet McKee.....830 Park Avenue.
Mrs. William Naumberg.....21 West 83 Street.
Mrs. Moses Newborg.....50 East 52 Street.
Miss Gertrude Parsons.....110 East 36 Street.
Miss T. E. Phillips.....850 West End Avenue.
Mrs. F. W. Rhinelander.....26 East 84 Street.
Miss Rose Roll.....201 East 82 Street.
*Miss Florence I. Rosen.....124 Featherbed Lane.
Miss S. J. Russell.....Dobbs Ferry, N. Y.
Miss Beatrice Schubach.....342 St. Ann's Avenue.
Mrs. A. G. Son.....White Plains, N. Y.
Miss Clara A. Stevens.....500 West 122 Street.
Mrs. Helen Sachs Straus.....27 West 72 Street.
Mrs. A. S. Swann.....124 East 61 Street.
Mrs. R. N. Thomas.....925 Park Avenue.

* Registered in two courses.

Mrs. W. H. Vialle . . . . . 419 West 119 Street.
Miss Lillie Wales . . . . . 1978 Crotona Avenue.
*Miss Rachel Weinberg . . . . . 142 West 112 Street.
Mrs. Butler Williamson . . . . . 944 Park Avenue.
Mrs. Josephine V. Winslow . . . . . Scarsdale, N. Y.
*Miss Lillie Zagat . . . . . 973 Summit Avenue.
Miss R. E. Zimmermann . . . . . 1340 Pacific Street.

Respectfully submitted,
HENRY G. PARSONS,
Supervisor of Gardening Instruction.

REPORT OF THE SUPERINTENDENT OF BUILDINGS AND GROUNDS

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to submit the following report as Superintendent of Buildings and Grounds for the year 1917.

Regulating and Grading

Much of this work was accomplished at the rose garden, convention garden, and the school garden. We excavated 1,500 cubic yards of earth from the cellar and trenches for the new houses at conservatory range 2, placing 300 yards of this at the northern boundary line near the Newell Avenue entrance connecting with the Bronx River Parkway, 300 yards in the magnolia collection in order to raise the low land, and 900 yards to grade the southern end of the new houses. About 300 yards of top-soil were transferred from the paths in the magnolia collection to complete the rose garden.

About 7,650 cubic yards of earth have been carted into the grounds by contractors who were excavating cellars in the vicinity of the Garden and who were looking for a place to dispose of the soil. This soil was deposited to our satisfaction at the contractors' expense. For filling in the new road at the northern end of the large lake near the rose garden, about 3,500 yards of this soil were used, 4,000 yards were placed north of the Woodlawn Avenue bridge along the railroad embankment, and about 150 yards in the large

swale of the convention garden. We removed about 150 yards of earth from power house 1 to the swale in the convention garden.

Drainage

In order to drain the western side of the rose garden, we used 60 feet of 4-inch tile pipe. To connect a path from the mansion to the school garden, we covered a culvert 4 feet wide and 14 feet long with stone 5 inches thick.

Roads and Paths

The Park Department tarred and covered with grit all roadways throughout the grounds. The iris garden and the convention garden have been connected with a 10-foot path 490 feet long and the herbaceous garden and the convention garden have been connected with a 10-foot path 360 feet long. We have paved, ashed, and screened 2,300 feet of 10-foot paths in the convention garden and have completed a path 15 feet wide and 168 feet long leading from the Southern Boulevard entrance to the circle of the convention garden. We have lined 400 feet of 10-foot paths running through the magnolia collection. A path 10 feet wide and 345 feet long from the Bronx Boulevard entrance to the school garden has been completed and a 10-foot path from the shelter-house to the new road, 480 feet long, was lined and paved; 846 feet of a 6-foot ashed path was built through the school garden. A connecting path 10 feet wide and 58 feet long was lined near the propagating houses.

We have excavated 400 yards of stone from the quarry near conservatory range 2 for the foundations of the new houses of this range, and 300 yards of stone were removed from the quarry near the museum building for the paths of the convention garden. For the paths of the rose garden, 200 yards of stone were excavated from the rose garden area.

Buildings

The mechanics have made considerable repairs throughout the Garden during the year. The carpenters repaired

several rafters in houses 2, 3, 5, and 6–11 of conservatory range 1 and repaired the roof of the stable and the stalls. Posts were set up for a distance of 720 feet to complete the cedar fence along the Southern Boulevard south of the herbaceous grounds, and thirteen cedar benches were built for use on the grounds.

The exterior of houses 2, 3, 5, and 6–11 and nearly all the doors of conservatory range 1 have been painted; also the exterior of two houses at conservatory range 2. The painter replaced all broken glass in conservatory ranges 1 and 2 and in the propagating houses.

Six concrete benches were built in conservatory range 1, two side benches 59 feet long and 3 feet wide in house 2, two side benches 60 feet long and 3 feet wide in house 3, and one side bench 80 feet long and 3 feet wide and one double center bench, the upper part 46 by 6 feet and the lower part 117 by 3 feet, in house 5.

A shelter-house with a cellar for tool storage has been completed, with the exception of the roof, at the school garden and a concrete compost bin 10 by 20 feet was built in the school garden.

The lake bridge, the three bridges crossing the Bronx River, and the south wall of power house 1 have been repointed. Considerable repairs were made to the walls of the museum building and the mansion by the plasterers. Repairs were made to the steam system of the museum building, conservatories, and comfort stations. Three sets of lavatories were placed in the mansion.

Water System

A 6-inch water-main pipe was extended with a 4-inch pipe 206 feet long along the new road on the eastern side of the grounds, to which an inch and a half pipe was connected to supply the school garden with water. We made five hose-taps to supply the rose garden and three to supply the convention garden with water. The 3-inch water-main pipe in the herbaceous grounds was connected to a 6-inch main by means of two 1½-inch taps.

Grounds

On Saturdays, Sundays, and holidays from Decoration Day to Labor Day, the Garden was patrolled by two detectives and five city officers, in addition to our own guards. The park ordinances regarding the scattering of paper, destruction of shrubbery, and general vandalism were successfully enforced. About 75 arrests were made, 10 of which were for the breaking of glass; the offenders were fined from one to fifteen dollars. The damage to the lawns and plantations was very slight. From May to September, about forty-eight picnic parties visited the Garden, each party numbering from 50 to 425 persons. They were escorted by our guards to those parts of the Garden set aside for picnic purposes; therefore, no damage was done to the plant collections. Visitors to the Garden on Sundays and holidays during the warm weather numbered about 45,000, increasing to 55,000 during July and August. The visitors to the museum and conservatories have still continued to increase over the number of each preceding year.

About 75 dead trees were cut down during the year. We kept the gasoline engine running for three weeks to cut wood for fuel for the propagating houses, mansion, and stable. The uprooting of the poison ivy has been continued with satisfactory results and will be continued until the ivy is exterminated from the grounds.

Two horses were purchased. About 70 tons of hay were cut during the summer months and 40 tons were put in the two barracks.

Respectfully submitted,

ARTHUR J. CORBETT,

Superintendent of Buildings and Grounds.

REPORT OF THE HONORARY CURATOR OF THE ECONOMIC COLLECTIONS

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to submit the following report for the Economic Museum for the year 1917.

The work of the year has consisted chiefly of the collection of specimens in Colombia representing the useful products of that republic, and in connection therewith, of its general flora. The determination, mounting, and arrangement of these specimens has occupied the whole of my attention since my return.

During the early part of the year, the addition to our collections consisted chiefly of drug specimens, secured in our local market.

In June I sailed, in company with Dr. Pennell of the Garden staff, for Colombia, returning in late September, with an economic collection of some fifty specimens, nearly all preserved in glass jars in formaldehyde solution. This collection is of unusual interest, representing a region of which the economic flora is very little known.

The most important part of the collection consists of six species of quinine-yielding barks, four in the genus *Cinchona* and two in *Remijia*. Next in importance are a large number of fleshy edible fruits in the genera *Tacsonia*, *Passiflora*, *Rheedia*, *Solanum*, *Cyphomandra*, *Rubus*, *Fragaria*, *Chrysobalanus*, *Physalis*, *Thibaudia*, *Cavendishia*, *Musa*, *Carica*, *Melicocca*, *Citrus*, *Martinezia*, *Acrocomia*, *Bromelia*, *Annona*, *Eugenia*, *Osteomeles*, and *Inga*. Other interesting edible products are a species of black walnut, soap-berries, a native bean of excellent quality, the tubers of *Oxalis tuberosa* and *Basella*, and flours made of casava root and of bananas. I also obtained a native root used for dyeing purposes.

Of many of these articles, seeds or living materials were obtained for propagation in our conservatories.

In addition to this material, about thirteen hundred numbers of a general botanical collection were secured.

Dr. Pennell remains in Colombia for the purpose of continuing these collections.

In submitting this report, I desire to add that so large an economic collection as we now possess, and one that represents so much labor and expense, should be made more serviceable than it is at present. Under the stimulus of present economic conditions, there is an unprecedented demand for information concerning useful plant products, and we are in continuous receipt of inquiries, both verbal and written, for such information. Our economic museum, plantations, and conservatories are capable of meeting a large portion of these demands, were their exhibits properly made known. This result, I believe, could be largely secured by the publication as a part of our *Bulletin*, and reprinted for special distribution, of a detailed catalogue and guide to these collections. Such a guide should explain our method of classification and indicate the location of the articles and the method of finding them. It should then enumerate them, indicating as to each its identity, nature and source, botanical and geographical, and its useful properties and economic relations. All this could be done briefly, yet would be productive of very valuable results, and could point the way to securing fuller information when desired. In addition to these benefits to the public, the Garden would be certain to profit largely through the direction of the attention of those having material to contribute to the absence of such articles from the catalogue.

Respectfully submitted,

H. H. Rusby,

Honorary Curator of Economic Collections.

REPORT OF THE HONORARY CURATOR OF FOSSIL PLANTS

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: I have the honor to report as follows upon activities in connection with the paleobotanical work of the Garden during the year 1917:

Early in the year a collection of fossil plants from Porto Rico—part of the material gathered in the joint natural history survey of the island by the New York Academy of Sciences and the American Museum of Natural History—was submitted to me for examination. The study of this collection has occupied a large part of the time at my disposal. The specimens are very imperfect, for the most part, and each one has to be drawn, as the character of the remains precludes the possibility of photographing them. During the months of April and May about six weeks were spent in Washington, working on the fossil flora of Alaska in connection with the United States Geological Survey. Certain features of this work have also received attention since my return.

Respectfully submitted,

ARTHUR HOLLICK,
Honorary Curator of Fossil Plants.

REPORT OF THE HONORARY CURATOR OF MOSSES

DR. N. L. BRITTON, DIRECTOR-IN-CHIEF.

Sir: No large collections of mosses have been purchased during the past year; 590 specimens have been received and 914 have been sent in exchange; this included some sets of Dr. Small's Florida mosses, the largest set having been sent to Mr. Charles Deering, of Miami, Florida, two others having been placed with collectors in the same state, thus encouraging an interest and knowledge of the local flora. The Isle of Pines mosses have been sent to the Colegio de la Salle in Cuba, to the National Herbarium in Washington and to the Carnegie Museum in Pittsburgh, Pennsylvania. Exchanges have been continued with the Sullivant Moss Society, of which I have had the honor to

serve as president during the past year, and Mr. George B. Kaiser as secretary of the Society has assisted me in the determination of collections sent in by members.

Our correspondents in Cuba, Jamaica, England, and France, have continued to send us specimens, and those of Brother Leon and Mr. Harris have proven to be of great interest. Mr. Dixon has examined and compared at Kew and the British Museum many of the unnamed specimens of exotic mosses from the Mitten Herbarium, and we are holding for future description by him a number of new species with manuscript names. During the year we have received one set of Dr. Grout's "Musci Pleurocarpi," and a copy of his "Moss Flora of N. Y. City and Vicinity," many of the local records of which are based on the collections here at the Garden. We have also received a set of Prof. Holzinger's Exsiccatae of Acrocarpous mosses.

During the summer, we have been asked to furnish information on peat mosses to be used for surgical dressings and have referred critical questions of determination to Dr. A. LeRoy Andrews, of Cornell University, who continues his cooperation and studies for *North American Flora.* The manuscript for the mosses of the "Flora of Bermuda" has been prepared, and I have made some progress in descriptions of the genus *Fissidens* for *North American Flora.*

Acting as secretary for the "Stokes Fund," I have contributed two short articles on "Our Parks" for publication in the journals of Edgar Allen Poe and the Gary schools (P. S. 45 and 46, The Bronx). I have also published in the May number of the *American Museum Journal* an article on the "Conservation of Wild Flowers," illustrated by photographs by Miss Dickerson, and "A Schedule for Arbor Day Compositions on Conservation" in the *Nature Study Review* for April. During the spring I visited about twenty of the local garden clubs and schools, giving a lecture on "Botanizing with a Camera," illustrated by lantern slides of the rare and beautiful, as well as some of

the more common, of our native plants and making a plea for their appreciation and conservation. Mr. Percy Wilson accompanied me and took excellent care of the lantern slides. At Princeton University we were most cordially received at the President's House and the lecture was given in one of the lecture rooms of the University. Mrs. Archibald D. Russell took me to visit some of the lovely gardens for which this town is famous. At the meeting of the Lenox Garden Club, Miss Olivia Phelps Stokes was present and I had an opportunity to thank her personally for the interesting and beautiful work she has enabled us to accomplish in the preservation of our wild flowers. A set of enlarged and colored photographs of some of our rare plants by Miss Kittredge has been donated by me and framed and hung in the mansion.

Respectfully submitted,

ELIZABETH G. BRITTON,

Honorary Curator of Mosses.

SUBSCRIPTIONS TO THE EMERGENCY FUND, 1917

Mr. Fritz Achelis	$ 50
Mr. Edward D. Adams	200
Mr. John W. Auchincloss	25
Mrs. Robert Bacon	50
Miss Elizabeth Billings	25
Mr. George Blumenthal	25
Dr. N. L. Britton	500
Mr. Andrew Carnegie	500
Mr. C. A. Coffin	25
Mrs. Charles D. Dickey	25
Mr. Cleveland H. Dodge	100
Mr. Samuel W. Fairchild	25
Mr. James B. Ford	500
Mr. Henry W. de Forest	50
Dr. Robert W. de Forest	50
Mr. Edward S. Harkness	100
Mrs. E. H. Harriman	50
Mr. Adrian Iselin, Jr.	100
Mr. Pierre Jay	25
Mrs. Delancey Kane	25
Mrs. John I. Kane	50
Mr. Edward V. Z. Lane	50
Dr. Albert R. Ledoux	50
Mr. Adolph Lewisohn	25
Mrs. V. Everit Macy	100
Mr. J. P. Morgan	500
Dr. Lewis Rutherfurd Morris	50
Mr. George W. Perkins	150
Mr. Charles F. Rand	50
Mr. Edwin A. Richard	250
Mr. Jacob H. Schiff	100
Mr. James A. Scrymser	50
Mr. Isaac N. Seligman	50
Mr. Francis L. Stetson	250
Mr. Frederick Strauss	20

Mrs. Henry O. Taylor	100
Mr. B. B. Thayer	25
Mr. Myles Tierney	50
Mr. Louis C. Tiffany	50
Mr. Grenville L. Winthrop	25
Total	$4,445

SCHEDULE OF EXPENDITURES DURING THE YEAR 1917

1. CITY MAINTENANCE ACCOUNT

Allowance		$109,760.00
Additional Allowance for Fuel		5,095.50
Total Appropriated		$114,855.50

Expended

Personal Service

Salaries	$ 83,458.67	
Labor	8,261.90	
Total		$ 91,720.57

Sundry Expenses

Forage	$ 1,028.77	
Fuel	15,025.77	
Supplies	1,553.10	
Equipment	1,570.82	
Materials	2,921.30	
Repairs	192.15	
Telephone Service	200.19	
Contingencies	642.83	
Total		$ 23,134.93
Total Expended		$114,855.50

2. SPECIAL GARDEN ACCOUNTS

EXPLORATION FUND

Balance from 1916	$ *24.05*

MUSEUM AND HERBARIUM FUND

Balance from 1916	$ *71.90*

PLANT FUND

Balance from 1916	$ *12.07*	
Contribution	100.00	
Sales	314.25	
Total		$ 426.32
Expended		87.92
Balance		$ *338.40*

Special Book Fund

Balance from 1916		*$ 49.74*
Contribution		.25
Sales		52.00
Transferred from Public Lecture Fund		3.47
Total		$ 105.46
Expended		4.20
Balance		*$ 101.26*

Public Lecture Fund

Balance from 1916		*$ 119.47*
Expended	$ 116.00	
Transferred to Special Book Fund.	*3.47*	
Total		$ 119.47

Rose Garden and Garden Extension Fund

Balance from 1916	*$ 35.70*	
Contribution	100.00	
Total		$ 135.70
Expended		101.85
Balance		*$ 33.85*

Rose Garden Stairway

Contribution		$ 2,000.00
Expended	$ 1,950.00	
Transferred to Plans, Surveys and Construction	*50.00*	
Total		$ 2,000.00

Erection of Steel Flagpoles

Contributions		$ 918.70
Expended		918.70

Garden School Fund

Contributions	$ 4,015.00	
Students' Fees	709.00	
Sale of tools and implements	44.00	
Total		$ 4,768.00
Expended		
Salaries	$ 2,645.01	
Labor	179.10	
Miscellaneous	1,470.71	
Total		$ 4,294.82
Balance		*$ 473.18*

GUGGENHEIM GREENHOUSE FUND

Contributions		$100,000.00
Expended		
Salaries	$ 700.00	
Labor	1,842.88	
Commission on Plans	3,000.00	
Contract—on a/c	4,000.00	
Miscellaneous	429.13	
Total		$ 9,972.01
Balance		*$90,027.99*

CONVENTION GARDEN FUND

Contributions		$ 800.00
Expended		
Salaries	$ 460.00	
Labor	198.50	
Miscellaneous	141.50	
Total		$ 800.00

SCHOOL GARDEN SUMMER HOUSE FUND

Contribution		$ 4,000.00
Expended		
Salaries	$ 155.00	
Labor	1,142.00	
Miscellaneous	1,327.69	
Total		$ 2,624.69
Balance		*$ 1,375.31*

EMERGENCY FUND

Contributions		$ 4,445.00
Expended		
Salaries	$ 1,730.00	
Labor	1,285.50	
Miscellaneous	1,329.37	
Total		$ 4,344.87
Balance		*$ 100.13*

SUMMARY OF SPECIAL GARDEN ACCOUNTS

Balances from 1916	$ *312.93*	
Contributions and Fees	117,087.95	
Sales	410.25	
Total		$117,811.13
Expended	$ 25,215.06	

Transferred to General Income Account	*50.00*
Total	*$ 25,265.06*
Balance	*$ 92,546.07*

3. SPECIAL INCOME ACCOUNTS

	Appropriated	*Expended*	*Balances*
Income of Science and Education Fund.			
Publications		$ 2,005.46	
Lectures		393.42	
Laboratories		449.13	
Photography		362.79	
Explanation		739.27	
Total	$ 3,960.00	$ 3,950.07	$ *9.93*
Income of Darius O. Mills Fund.			
Museums		$ 605.00	
Herbarium		592.62	
Books and Binding		1,064.00	
Investigations at other Institutions		26.50	
Total	$ 2,300.00	$ 2,288.12	$ *11.88*
Income of Henry Iden Fund.			
Research Scholarships	$ 400.00	$ 300.00	$ *100.00*
Income of William R. Sands Fund.			
Horticultural Prizes	$ 465.00	$ 462.00	$ *3.00*
Accumulated Income of Olivia E. and Caroline Phelps Stokes Fund.			
For the Preservation of Native Plants	$ 215.00	$ 210.66	$ *4.34*
Accumulated Income of Students' Research Fund.			
Aid for Students' Research	$ 250.00	————	$ *250.00*
Income of David Lydig Fund.			
Publications	$ 5,100.00	$ 5,055.46	$ *44.54*

	Appropriated	*Expended*	*Balances*
Accumulated Income of Addison Brown Fund.			
For Preparation, Publication and Distribution of Addisonia.			
Salary of Artist		$ 330.00	
Printing and Stationery		3,698.06	
Miscellaneous		224.25	
Total	$ 4,275.00	$ 4,252.31	$ *22.69*
Income of John Innes Kane Fund.			
Plants for Grounds and Greenhouses	$ 600.00	$ 484.12	$ *115.88*

Income of Maria DeWitt Jesup Fund.			
For Increase of the Collections.			
Books		$ 585.99	
Specimens		170.52	
Total	$ 900.00	$ 756.51	$ *143.49*
Accumulated Income of Charles Budd Robinson Fund.			
For aiding Exploration	$ 60.00	———	$ *60.00*
Totals—Special Income Accounts	$ 18,525.00	$ 17,759.25	$ *765.75*

4. GENERAL INCOME ACCOUNT

	Appropriated	*Expended*	*Balances*
INSURANCE			
Museum Specimens and Library		$ 366.60	
Boilers and Elevator		114.19	
Horses and Wagons		4.00	
Total	$ 485.00	$ 484.79	$ *.21*
SUPPLIES (INCLUDING CIRCULARS FOR MEMBERS)			
Circulars		$ 313.60	
Supplies		1,125.09	
Total	$ 1,440.00	$ 1,438.69	$ *1.31*
CONTINGENT FUND			
Miscellaneous	$ 837.00	$ 835.42	$ *1.58*
ENTERTAINMENT			
Refreshments		$ 200.00	
Hire of Touring Cars		315.70	
Printing, Postage and Stationery		244.21	
Total	$ 763.00	$ 759.91	$ *3.09*
ASSISTANCE FOR TREASURER			
Services rendered	$ 480.00	$ 480.00	———
SALARIES AND LABOR			
Salaries			
Individual Accounts	$ 13,248.00		
Museum Aids	256.00		
Miscellaneous	131.50		
Total		$ 13,635.50	
Labor			
Weekly Pay Rolls	$ 41.00		
Guard Duty	440.00		
Miscellaneous overtime	411.61		
Total		$ 892.61	
Totals—Salaries and Labor	$ 14,540.00	$ 14,528.11	$ *11.89*

	Appropriated	*Expended*	*Balances*
PLANS, SURVEYS AND CONSTRUCTION			
Appropriated	$ 4,575.00		
Transferred from Special Garden Accounts	50.00		
Expended			
Paintings		$ 1,825.00	
Plans and Surveys		1,591.05	
Construction		1,192.63	
Total	$ 4,625.00	$ 4,608.68	$ *16.32*

SUMMARY OF GENERAL INCOME ACCOUNT

Appropriated	$ 23,120.00		
Transferred from Special Garden Accounts	50.00		
Total	$ 23,170.00	$ 23,135.60	$ *34.40*

5. EXPENDED FROM FUNDS OF THE GARDEN

Special Garden Accounts	$ 25,215.06
Special Income Accounts	17,759.25
General Income Account	23,135.60
Total	$ 66,109.91

6. BOARD ROOM FUND

Jany 1, 1917. Balance—Cash		$ *31.17*
Gross Receipts, Jany 1 to Dec. 31, 1917	$ 206.15	
Loss—Credited to Income of Lydig Fund	11.50	$ 194.65
Total—Net Receipts		$ 225.82
DISBURSEMENTS		
Supplies	$ 149.67	
Contingencies	30.16	
Total		$ 179.83
Dec. 31, 1917. Balance—Cash		$ *45.99*

Respectfully submitted,
WALTER S. GROESBECK,
Accountant.

E. and O. E.
NEW YORK, January 14, 1918.

REPORT OF THE CHAIRMAN OF THE SCIENTIFIC DIRECTORS

To the Board of Managers of the New York Botanical Garden.

Sirs: On behalf of the Scientific Directors, I would report that in our advisory relations with Dr. Britton we have held the usual stated meetings throughout the past year. The publications, lecture courses, botanical exploration, new construction, school garden, and other scientific and educational activities of the Garden have been considered and the concrete data as to the work of the year are represented in detail in the report of the Director-in-Chief.

Considerable attention has been given to the possibility of active contributions by the Garden in the direction of the application of botanical science to meeting the present food and other war emergencies of the country. It was agreed that the efforts of the Garden might best be devoted to researches which would have permanent interest and significance for increasing crop production. A comprehensive plan for the investigation of the fungous, bacterial, and algal flora of the soil was worked out and has been submitted to you.

It is fitting that the many years of active and efficient service of the retiring Chairman of the Scientific Directors, Dr. H. H. Rusby, should be recognized at this time. On behalf of his fellow members in the Board, I wish to express their high appreciation of his untiring devotion to the interests of science and his stimulating and unfailingly courteous leadership and cooperation in the work of the Garden.

Respectfully submitted,

R. A. Harper,
Chairman.

REPORT OF THE COMMITTEE ON PATRONS, FELLOWS, AND MEMBERS FOR THE YEAR 1917

To the Board of Managers of the New York Botanical Garden.

Gentlemen: The number of new members who have qualified is 67. The number of annual members is now 899; life members 142; sustaining members 12; fellowship members 2.

Of these 34 are now in arrears for dues for 1917, 9 for dues for 1916 and 1917, 4 for dues for 1915, 1916 and 1917.

Dues have been collected to the amount of $9,140. One person has qualified as a fellow for life by the payment of $1000. These sums have been transmitted to the treasurer.

A complete list of all classes of members to date is herewith submitted.

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Columbia University,
*Hon. Chas. P. Daly,
Daniel Guggenheim,
Murry Guggenheim,
*D. O. Mills,
*J. Pierpont Morgan, Sr.
John D. Rockefeller,
*Cornelius Vanderbilt.

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*Hon. Addison Brown,
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*William E. Dodge,
James B. Ford,
George J. Gould,
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Archer M. Huntington,
*Henry Iden,
Mrs. John Innes Kane,
*John Stewart Kennedy,
*J. Pierpont Morgan, Sr.,
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*Lowell M. Palmer,
William Rockefeller,
*William R. Sands,
*William C. Schermerhorn,
James A. Scrymser,
Mrs. Finley J. Shepard,
Samuel Sloan,
Mrs. Frederick F. Thompson,
W. K. Vanderbilt,
Mrs. Antoinette Eno Wood,

* Deceased.

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Mrs. W. Bayard Cutting,
Dr. Robert W. de Forest,
Cleveland H. Dodge,
James B. Ford,
Daniel Guggenheim,
Murry Guggenheim,
S. R. Guggenheim,
Mrs. John Stewart Kennedy,
Edward V. Z. Lane,
Mrs. Frederic S. Lee,
James McLean,
Ogden Mills,
George W. Perkins,
M. F. Plant,
Mrs. John A. Roebling,
Mortimer L. Schiff,
James A. Scrymser,
Francis Lynde Stetson,
Miss Olivia E. Phelps Stokes ,
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Samuel D. Babcock,
Geo. V. N. Baldwin,
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George D. Barron,
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Gustav Baumann,
Samuel R. Betts,
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George Blumenthal,
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E. C. Jameson,
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Mrs. John J. Lapham,
Lewis H. Lapham,
Countess de Laugier-Villars,
John Burling Lawrence,
Henry Goddard Leach,
Prof. Frederic S. Lee,
Marshall C. Lefferts,
Wm. H. Lefferts,
George Legg,
James M. Lehmaier,
Wm. H. Leupp,
Edmund J. Levine,
G. Levor,
Louis S. Levy,
Adolph Lewisohn,
Miss Alice Lewisohn,
Paul Lichtenstein,
John E. Liggett,
E. K. Lincoln,
Frederick J. Lisman,
Lucius N. Littauer,

Mrs. John R. Livermore,
Miss Anna P. Livingston,
Mrs. Francis G. Lloyd,
Wm. C. Lobenstine,
Mrs. I. Ferris Lockwood,
Frank J. Logan,
Russell H. Loines,
Mrs. Geo. de Forest Lord,
Lord & Burnham Co.,
P. Lorillard, Jr.,
Ethelbert I. Low,
Miss Carlotta R. Lowell,
August Lueder,
Walther Luttgen,
Mrs. N. H. Luttrell,
William M. Lybrand,
Mrs. C. B. Macdonald,
Clarence H. Mackay,
Kenneth K. Mackenzie,
Mrs. Charles F. MacLean,
Malcolm MacMartin,
George H. Macy,
V. Everit Macy,
F. Robert Mager,
J. H. Maghee,
Pierre Mali,
Chas. Mallory,
Miss Delia W. Marble,
John Markle,
Mrs. John Markle,
Dr. J. W. Markoe,
Otto Maron,
Mrs. Henry Marquand,
Edwin S. Marston,
Dr. Walton Martin,
William J. Matheson,
Robert Maxwell,
Harry Mayer,
Dr. D. H. McAlpin,
Geo. L. McAlpin,

George McAneny,
Henry P. McKenney,
John A. McKim,
James McLean,
Edward F. McManus,
William McNair,
B. Frank Mebane,
Morton H. Meinhard,
Dr. Walter Mendleson
Herman W. Merkel,
John L. Merrill,
Manton B. Metcalfe,
Herman A. Metz,
Edwin O. Meyer,
Eugene Meyer, Jr.,
George A. Meyer,
Harry J. Meyer,
William Michel,
John G. Milburn,
Geo. M. Miller,
Dr. Adelaide Mills,
Mrs. John Murray Mitchell,
Barrington Moore,
Clement Moore,
J. C. Moore,
Miss Katherine T. Moore,
Miss Anne Morgan,
Miss C. L. Morgan,
E. D. Morgan,
Mrs. J. P. Morgan,
Wm. Fellows Morgan,
W. Forbes Morgan, Jr.,
Mrs. Cora Morris,
Mrs. Dave Hennen Morris,
Henry Lewis Morris,
Dr. Lewis R. Morris,
Dwight W. Morrow,
Richard Mortimer,
Henry C. Mott,
Mrs. John B. Mott,
Frank J. Muhlfeld,
Carl Muller,
Rev. Joseph A. Mulry, S. J.
John P. Munn,
Frank A. Munsey,
William S. Myers,
A. G. Nesbitt,
Mrs. Russell H. Nevins,
Miss Catherine A. Newbold,
Miss Edith Newbold,
Frederic R. Newbold,
Mrs. William G. Nichols,
William H. Nichols,
Wm. Nilsson,
George Notman,
Howard Notman,
Adolph S. Ochs,
John Offerman,
P. M. Ohmeis,
E. E. Olcott,
Elam Ward Olney,
Robert Olyphant,
R. M. Olyphant,
Mrs. Emerson Opdycke,
Mrs. Wm. Openhym,
Myron H. Oppenheim,
William C. Orr,
Prof. Henry F. Osborn,
Mrs. William Church Osborn,
Joseph Osler,
Miss Elizabeth H. Packard,
Fred'k Page Co.,
Augustus G. Paine,
Henry Parish, Jr.,
Junius Parker,
Winthrop Parker,
James C. Parrish,
Chas. W. Parsons,
Miss Gertrude Parsons,
W. A. Paton,

Mrs. Frederick Pearson,
Charles E. Peck,
Dr. Charles H. Peck,
Mrs. Wheeler H. Peckham,
Edward S. Pegram,
Mrs. Sarah G. T. Pell,
Edmund Penfold,
Mrs. William A. Perry,
Samuel T. Peters,
W. R. Peters,
Carl Schurz Petrasch,
Curt G. Pfeiffer,
Mrs. von R. Phelps,
Henry Phipps,
Lloyd Phoenix,
Phillips Phoenix,
Carl Pickhardt,
Gottfried Piel,
Henry Clay Pierce,
Winslow S. Pierce,
Mrs. R. Stuyvesant Pierrepont,
J. Fred Pierson,
Mrs. Frank H. Platt,
Edward Plaut,
Gilbert M. Plympton,
Bernard Pollak,
Chas. Lane Poor,
James E. Pope,
Alexander J. Porter,
Abram S. Post,
Miss Blanche Potter,
Frederick Potter,
Mrs. George D. Pratt,
Mrs. Herbert Lee Pratt,
John T. Pratt,
Mrs. L. B. Preston,
R. B. Price,
Miss Cornelia Prime,
Thomas R. Proctor,
Mrs. Kate Davis Pulitzer,
H. St. Clair Putnam,
Miss Eva C. Putney,
Percy R. Pyne,
Charles F. Quincy,
Dr. Edward Quintard,
Charles Raht,
Edmund D. Randolph,
Stanley Ranger,
G. B. Raymond,
Mrs. William A. Read,
Miss Emily Redmond,
Geraldyn Redmond,
John Reid,
Geo. N. Reinhardt,
Chas. Remsen,
Howard Price Renshaw,
Miss Elvine Richard,
Oscar L. Richard,
Eben Richards,
E. O. Richards,
M. M. Riglander,
Wm. J. Riker,
Dr. Wm. C. Rives,
Miss Emeline Roach,
G. Theo. Roberts,
Miss Mary M. Roberts,
Miss Jennette Robertson,
Louis J. Robertson,
Andrew J. Robinson,
J. K. Robinson,
William G. Rockefeller,
Edward L. Rogers,
Miss Harriette Rogers,
Hubert E. Rogers,
A. J. Rolle,
W. Emlen Roosevelt,
Mrs. W. Emlen Roosevelt,
Hon. Elihu Root,
Henry C. Rosenbaum,
Jacob Rossbach,

C. H. Ruddock,
Louis Ruhl,
Mrs. A. D. Russell,
Miss M. L. Russell,
John Barry Ryan,
Arthur Ryle,
Harry Sachs,
Samuel Sachs,
Clarence Sackett,
Mrs. Russell Sage,
Daniel C. Sands,
Miss G. W. Sargent,
Herbert L. Satterlee,
Mrs. Herbert L. Satterlee,
Hermann Schaaf,
Fred'k Müller Schall,
George E. Schanck,
Mrs. George E. Schanck,
John Scheepers,
Anton Schefer,
Mrs. H. M. Schieffelin,
Dr. Wm. J. Schieffelin,
Charles A. Schieren,
Gustave H. Schiff,
Rudolph E. Schirmer,
C. P Schlicke,
Miss Jane E. Schmelzel,
Fedor Schmidt,
D. Schnakenberg,
Henrich Schniewind, Jr.,
Louis B. Schram,
Henry Schreiter,
B. Schutz,
C. M. Schwab,
Gustav Schwab, Jr.,
Robert J. F. Schwarzenbach,
Walter Scott,
Miss Grace Scoville,
Robert Scoville,
Mrs. Arthur H. Scribner,
Edward M. Scudder,
Alonzo B. See,
Charles E. Seitz,
Prof. Edwin R. A. Seligman,
Jefferson Seligman,
E. W. Sells,
Mrs. Charles H. Senff,
Alfred Seton,
Mrs. William F. Sheehan,
George R. Sheldon,
Finley J. Shepard,
James Shewan,
Wm. Shillaber,
Alfred L. Simon,
John W. Simpson,
Charles A. Singer,
Francis Louis Slade,
Benson B. Sloan,
Samuel Sloan,
Thomas Smidt,
Daniel Smiley,
Miss Fanny A. Smith,
Frank Morse Smith,
Pierre J. Smith,
R. A. C. Smith,
E. G. Snow,
Mrs. Charlotte Sorchan,
Mrs. Edward W. Sparrow,
Mrs. Gino C. Speranza,
J. R. Stanton,
James H. Stebbins,
James R. Steers,
Chas. H. Steinway,
Fred. T. Steinway,
Wm. R. Steinway,
Olin J. Stephens,
Roderick Stephens,
Benjamin Stern,
Sereno Stetson,
Mrs. Byam K. Stevens,

Frederic W. Stevens,
Dr. Geo. T. Stevens,
Mrs. John Wood Stewart,
Lispenard Stewart,
Wm. R. Stewart,
Chauncey Stillman,
Miss Clara F. Stillman,
Dr. D. M. Stimson,
James Stokes,
Mrs. Willard Straight,
H. Grant Straus,
Roger W. Straus,
Albert Strauss,
Chas. Strauss,
Frederick Strauss,
Martin Strauss,
Samuel Strauss,
Edward W. Strobhar,
Mrs. Gustav Stromberg,
Benj. Strong, Jr.,
John R. Strong,
Mrs. Theron G. Strong,
Joseph Stroock,
F. K. Sturgis,
Mrs. F. K. Sturgis,
Mrs. James Sullivan,
Miss Mary Taber,
Henry W. Taft,
E. H. T. Talmage,
C. A. Tatum,
Henry R. Taylor,
W. A. Taylor,
C. H. Tenney,
H. L. Terrell,
Mrs. John T. Terry,
Thomas Thacher,
Miss M. J. Thayer,
Mrs. Hector W. Thomas,
Mrs. Howard L. Thomas,
Percival Thomas,
Seth E. Thomas, Jr.,
L. S. Thompson,
Lewis M. Thompson,
Loren Ogden Thompson,
William B. Thompson,
Dr. W. Gilman Thompson,
Jonathan Thorne,
Samuel Thorne, Jr.,
W. V. S. Thorne,
Myles Tierney,
Louis C. Tiffany,
Henry N. Tifft,
H. M. Tilford,
James Timpson,
J. Kennedy Tod,
P. S. Trainor,
A. F. Troescher,
Frederick K. Trowbridge,
Carll Tucker,
Dr. Alfred Tuckerman,
Paul Tuckerman,
Geo. E. Turnure,
Benjamin Tuska,
Mrs. Mary A. Tuttle,
E. S. Twining,
Lucien H. Tyng,
Oswald W. Uhl,
Theodore N. Vail,
James J. Van Alen,
Mrs. Frederick T. Van Beuren,
Barend Van Gerbig,
E. H. Van Ingen,
Mrs. Warner M. Van Norden,
Edgar B. Van Winkle,
Hon. Robert A. Van Wyck,
Mrs. Wilbur Linwood Varian,
Mrs. James M. Varnum,
Richard C. Veit,
Thos. F. Vietor,
Alfonso P. Villa,

Mrs. Gustavus A. Walker,
James N. Wallace,
Leo Wallerstein,
Dr. Max Wallerstein,
Wm. I. Walter,
Artemus Ward,
Mrs. John I. Waterbury,
C. W. Watson,
Thomas L. Watt,
Mrs. E. H. Weatherbee,
H. Walter Webb,
J. G. Webb,
Mrs. W. Seward Webb,
Miss Alice D. Weekes,
Chas. Wehrhane,
Charles H. Weigle,
Bernard Weinig,
Mrs. C. Gouveneur Weir,
Mrs. Samuel W. Weiss,
Mrs. John Wells,
Oliver J. Wells,
Arthur L. Wessell,
Dr. William West,
Mrs. Robert E. Westcott,
William Young Westervelt,
Miss Edith Wetmore,
Mrs. Alice T. Wheelock,
Dr. Wm. E. Wheelock,
Miss Caroline White,
Mrs. Stanford White,
Clarence Whitman,
Miss Margaret S. Whitney,
Edward A. Wickes,
Elmore A. Willets,
Mrs. Percy H. Williams,
Richard H. Williams,
William H. Williams,
W. P. Willis,
James R. Williston,
Frank D. Wilsey,
Prof. Edmund B. Wilson,
Miss Margaret B. Wilson,
M. Orme Wilson,
Bronson Winthrop,
Grenville L. Winthrop,
Mrs. Robt. Winthrop,
Mrs. Frank S. Witherbee,
Emil Wolff,
Lewis S. Wolff,
William E. Wolff,
Prof. R. S. Woodward,
F. W. Woolworth,
Miss Julia Wray,
Mrs. J. Hood Wright,
Mrs. A. Murray Young,
Joseph A. Zanetti,
Mrs. Anna M. von Zedlitz,
Charles H. Zehnder,
Charles Zoller,
O. F. Zollikoffer.

Members of the Women's Auxiliary

Mrs. Robert Bacon,
Mrs. Thomas H. Barber,
Miss Elizabeth Billings,
Miss Eleanor Blodgett,
Mrs. Charles D. Dickey,
Mrs. Walter Jennings,
Mrs. Delancey Kane,
Mrs. Hamilton F. Kean,
Mrs. A. A. Low,
Mrs. Charles Mac Veagh,
Mrs. V. Everit Macy,
Mrs. Henry Marquand,
Mrs. George W. Perkins,
Mrs. George D. Pratt,

Miss Harriette Rogers,
Mrs. James Roosevelt,
Mrs. Archibald D. Russell,
Mrs. Benson B. Sloan,
Mrs. Henry O. Taylor,
Mrs. George Cabot Ward.

Honorary Members of the Women's Auxiliary

Mrs. E. Henry Harriman,
Mrs. John I. Kane,
Miss Olivia E. P. Stokes,
Mrs. F. K. Sturgis,
Mrs. F. F. Thompson.

REPORT OF THE TREASURER

NEW YORK, January 12, 1918

TO THE BOARD OF MANAGERS OF THE NEW YORK BOTANICAL GARDEN.

Gentlemen: Herewith I submit a statement of my receipts and disbursements during the year 1917, and balance sheet from my ledger as of December 31, 1917.

Respectfully submitted,

JAMES A. SCRYMSER,
Treasurer.

RECEIPTS

Balance, from Annual Report of 1916		$ 10,516.66
Life Fellowship Fee credited Endowment Fund	$ 1,000.00	
David Lydig Bequest, additional	188.00	
Legacy Maria DeWitt Jesup, 10% of the amount (final payment)	2,500.00	
Contributions to Students Research Fund	121.00	
Contributions to the Rose Garden and Garden Extension Fund	105.00	
Contribution of Messrs. Daniel Guggenheim and Murry Guggenheim for the Guggenheim Greenhouse Fund	100,000.00	
Contributions to the Garden School Fund	4,768.00	
Contributions to Emergency Fund	4,445.00	
Contributions to the Convention Garden Fund	800.00	
Gift of Mrs. Frederick F. Thompson for the School Garden Summer House Fund	4,000.00	
Gift of Edward D. Adams for the erection of Two Steel Flag Poles	918.70	
Gift of Mrs. Robert E. Westcott, of Stone Stairway for Rose Garden	2,000.00	
Contributions to Special Fund for Books	52.25	

Contributions from New York City towards Development and Maintenance	101,038.54
Investment of Scence and Education Fund, New York City Notes, 6% maturing September 1st	50,000.00
Investment of John Innes Kane Fund, New York City Notes, 6% maturing September 1st	10,000.00
Subscriptions to "Addisonia" credited to Income of Addison Brown Fund	2,582.00
Annual Dues	8,670.00
Fellowship Members Fees	200.00
Sustaining Members Fees	300.00
Subscriptions to "North American Flora," Sales of Publications, credited to Income of David Lydig Fund	2,881.84
Plant Fund	414.25
Sales credited to Income of Stokes Fund	25.85
Sales of Ashes, Horse, Scrap Iron, and Junk	218.75
Income from Addison Brown Fund, (amount received for binding)	2.00
First Liberty Loan Subscription, $5,000. Received from employees on account of same	4,320.00
Second Liberty Loan Subscription, $5,000. Received from employees on account of same	1,755.00
Income from Investment of John Innes Kane Fund, 6% on $10,000 N. Y. City Notes	600.00
Income from Investment of Maria De-Witt Jesup Fund, 4% on $15,000 Northern Pacific Prior Lien Bonds	600.00
Income from Investment of Addison Brown Fund, 4% on $22,000 Northern Pacific Prior Lien Bonds	880.00
Income from Investment of Guggenheim Greenhouse Fund, being interest at	

3% on balances of this Fund deposited with Messrs. J. P. Morgan and Company.....		1,467.35
Interest Account, being interest at 3% on balances deposited with Messrs. J. P. Morgan and Company for the year 1917, (credited to General Income Account).....		546.12
Income from General Investments:		
Credited to General Income Account:		
5% on $50,000 Southern Rwy. 1st Consolidated Mortgage Bonds.....	$2,500.00	
4½% on $50,000 Ches. & Ohio R. R. Co. General Mortgage Bonds.....	2,250.00	
4% on $50,000 Erie Railroad Co. Prior Lien Bonds....	2,000.00	
4% on $59,000 Erie Railroad Co. Penn.-Coll. Trust Bonds.....	2,360.00	
4% on $50,000 Reading R. R. Co. Bonds, Jersey Central Coll. Tr.....	2,000.00	
4% on $24,000 Northern Pac. R. R. St. Paul, Duluth Divn.....		960.00
4% on $35,000 Northern Pac. R. R. Bonds, Gt. Nor. C. B. & Q. Trust...	1,400.00	
5% on $10,000 Louisville & Nash. R. R. Equipment Notes.....		500.00
4% on $10,000 New York City Stock, due 1959.....		400.00
4½% on $10,000 N. Y. Central Lines Equipment Notes.....		450.00
4% on $11,000 Milwaukee Sparta & No. West. R. R. Bonds.....		440.00

4½% on $50,000 Pennsylvania R. R. General Mtge. Bonds	2,250.00		
6% on $50,000 New York City Notes	3,000.00		
5% on $10,000 Balto. & Ohio R. R. Bonds	500.00	21,010.00	328,409.65
			$338,926.31

DISBURSEMENTS

Investments:

Account Endowment Fund for Science and Education, $50,000. Great Northern Railway Company 5% Coll. Gold Notes, due Sept. 1st, 1920	$ 48,796.88	
Account John Innes Kane Fund, $10,000. Great Northern Railway Company 5% Coll. Gold Notes, due Sept. 1st, 1920	9,759.37	
Account Guggenheim Greenhouse Fund, $75,000. New York Central Railroad Company Two Year 5% Coll. Trust Gold Notes, due Sept. 15th, 1919	72,750.00	$131,306.25

Expenses paid Through Director-in-Chief:

Account of New York City appropriations	$101,038.54	
General Accounts for Vouchers Paid	24,499.31	
Rose Garden and Garden Extension Fund	1,189.43	
Garden School Fund	3,793.06	
Convention Garden Fund	800.13	
Guggenheim Greenhouse Fund	9,316.78	
School Garden Summer House Fund	1,622.00	
Stone Stairway for Rose Garden	1,950.00	
Erection of Two Steel Flag Poles	918.70	
Emergency Fund	2,838.91	
Plant Fund for Purchase of Plants	114.00	
Income of David Lydig Fund, for Publications	3,201.37	

Income of D. O. Mills Fund, for Sundries	2,275.57	
Income of Stokes Fund, for Printing	209.14	
Income of Science and Education Fund	2,582.15	
Income of Henry Iden Fund	300.00	
Income of William R. Sands Fund	317.00	
Income of John Innes Kane Fund	543.63	
Income of Maria DeWitt Jesup Fund	697.57	
Income of Addison Brown Fund	3,761.60.	
Public Lecture Fund	183.50	162,132.39
Sundry Accounts:		
Subscription to First Liberty Loan, for account of Garden employees	$ 5,000.00	
Subscription to Second Liberty Loan, for account of Garden employees	5,000.00	
Income from General Investments, Interest, $50,000. Great Northern Railway Bonds, (paid on purchase, later to offset by Income received)	111.11	
Income from Investment John Innes Kane Fund, $10,000. Great Northern Railway Bonds (paid on purchase,later to offset by Income rec'd)	22.22	
Income from Investment Guggenheim Greenhouse Fund, interest on New York Central Notes $75,000 (paid on purchase, later to offset by Income received)	197.92	10,331.25
		$303,769.89
Balance, being Cash in hands of Treasurer, on deposit with Messrs. J. P. Morgan and Company	35,156.42	
		$338,926.31

Ledger Balances, December 31, 1917

Permanent Funds:	*Credit*
Endowment Fund	$306,010.00
Endowment Fund, for Science & Education	83,461.90
David Lydig Fund, Bequest of Charles P. Daly	34,337.86

Legacy of Wm. R. Sands	10,000.00
Darius Ogden Mills Fund	50,000.00
Henry Iden Legacy	10,000.00
Addison Brown Legacy	21,850.00
John Innes Kane Fund	10,000.00
Stokes Fund	3,000.00
Charles Budd Robinson Memorial Fund	652.30
Maria DeWitt Jesup Legacy	25,000.00
Students Research Fund	4,003.00
Temporary Funds:	
Guggenheim Greenhouse Fund	$ 92,150.57
Rose Garden and Garden Extension Fund	13.85
Garden School Fund	974.94
Emergency Fund	1,606.09
School Garden Summer House Fund	2,378.00
Income Maria DeWitt Jesup Fund	15.55
Income Students Research Fund	351.32
Income John Innes Kane Fund	36.85
Income Addison Brown Fund	2,061.02
Income Charles Budd Robinson Fund	58.32
Special Fund for Books	151.84
Plant Fund	466.32
Exploration Fund	24.05
Museum and Herbarium Fund	26.08
	$658,629.86

General Investments	*Debit*	
$50,000 Ches. & Ohio Gen'l Mtge. Bonds		
50,000 So. Ry. Co. 1st Cons. Mtge Bonds		
50,000 Erie R. R. Co. Prior Lien Bonds		
59,000 Erie R. R. Co. Penn.-Coll. Tr. Bonds		$312,424.18
50,000 Reading R. R. Co. J. C. Coll. Tr. Bonds		
24,000 Nor. Pac. R. R.-St. P. & D. Div. Bonds		
30,000 Nor. Pac. Gt. Nor.-C. B. & Q. Coll. Tr. Bonds		
10,000 N. Y. City, 4% Stock, 1959		

Investment, D. O. Mills Fund,		
$50,000 Penn. R. R. Genl. Mtg. Bonds, 4½%.....	$ 50,418.33	
Investment, Science & Education Fund,		
$10,000 N. Y. Cent. Lines Eqpt.		
10,000 Louisville & Nashville Eqpt.		
10,000 Balto. & Ohio Refunding Genl. Mtg. Bds. due Dec. 1995, 5%,		
5,000 Chic. Burlington & Quincy R. R. Jt. 4s. July 1st, 1921,		
50,000 Gt. Nor. Rwy. 5% Gold Notes due Sept. 1, 1920.....	84,532.36	
Investment, Henry Iden Fund,		
$11,000 Milwaukee, Sparta & No. W. R. R. Bonds.....	10,120.00	
Investment, Addison Brown Legacy,		
$22,000 Nor. Pac. Prior Lien Bds, 4%.	21,380.69	
Investment, John Innes Kane Fund,		
$10,000 Gt. Northern Rwy. Co. 5%, Gold Notes due Sept. 1, 1920.....	10,015.62	
Investment, Maria De Witt Jesup Fund,		
$15,000 No. Pac. Prior Lien Bonds,4%	13,378.75	
Investment, Guggenheim Greenhouse,		
$75,000 N. Y. Central Lines, 1919....	72,750.00	
Investment of David Lydig Fund,		
Balance borrowed from Permanent Fund.....	1,471.45	
Income of Stokes Fund.....	90.99	
Director-in-Chief Working Fund.....	25,000.00	
General Income Account, Balance borrowed from Permanent Fund.....	17,768.02	
Cash in Hands of Treasurer, Jan. 1, 1918, on deposit with J. P. Morgan & Co..	35,156.42	
Convention Garden Fund.....	.13	
Investment from Investment Guggenheim Greenhouse Fund.....	197.92	
First Liberty Loan subscription, Balance unpaid.....	680.00	
Second Liberty Loan, subscription.....	3,245.00	
	$658,629.86	$658,629.86

REPORT OF THE SPECIAL AUDITOR

Treasurer's Account for the Year 1917

Room 3111, Grand Central Terminal
New York, March 20, 1918

Mr. Edward D. Adams,
Chairman, Finance Committee, New York Botanical Garden,
71 Broadway, New York, N. Y.

Dear Sir:

This is to certify that I have, by direction of the Board of Managers, examined the books and accounts of the Treasurer of the New York Botanical Garden, for the year nineteen hundred and seventeen (1917), together with their proper vouchers, and that I find the balance sheet and the Treasurer's statement of receipts and disbursements attached hereto to be correct.

I have also examined the various investment securities and find the same to be as reported in the said balance sheet.

Respectfully submitted,
A. W. Stone,
Special Auditor.

Director-in-Chief's Account for the Year 1917

Room 3111, Grand Central Terminal
New York, March 20, 1918

Mr. Edward D. Adams,
Chairman, Finance Committee, New York Botanical Garden,
71 Broadway, New York, N. Y.

Dear Sir:

This is to certify that I have examined and audited the financial books and accounts of the Director-in-Chief of the New York Botanical Garden for the year nineteen hundred and seventeen (1917), and that I find the same to be correct, and the cash balance to be as stated in the current cash book.

In accordance with recent practice, I have not included in this auditing the examination of the vouchers for City maintenance or construction work paid for by the City, as such vouchers have been found proper and in order by the City authorities, and it was decided in 1904 by the Chairman of the Finance Committee that a further examination of them was unnecessary. By like authority I have omitted also a detailed examination of the annual membership dues account. These dues are received by the Director-in-Chief and forwarded by him to the Treasurer, the former keeping a detailed record of the same.

Respectfully submitted,
A. W. Stone,
Special Auditor.

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